Skyways

Flight Operations • Business Commercial Military

AUGUST 1955

■ Executive Pilot's Report: Twin-Jet Morane-Saulnier 760

■ From Pistons to Turboprops

■ Flight Operations Round Table: Additives in Aero Fuels & Oils

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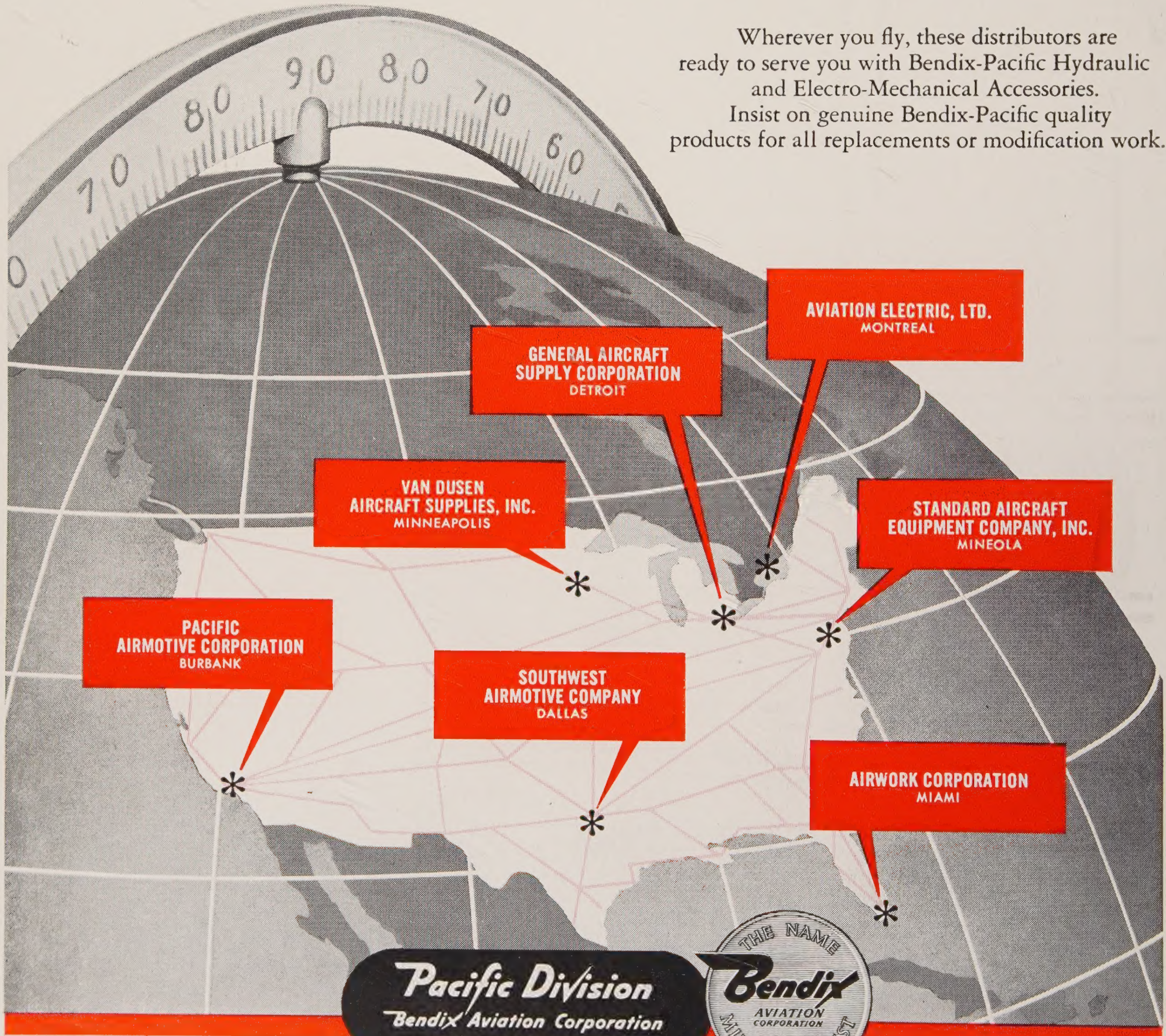

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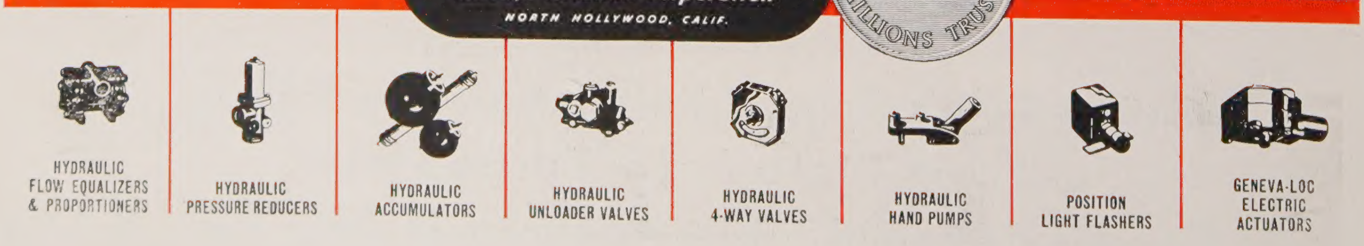

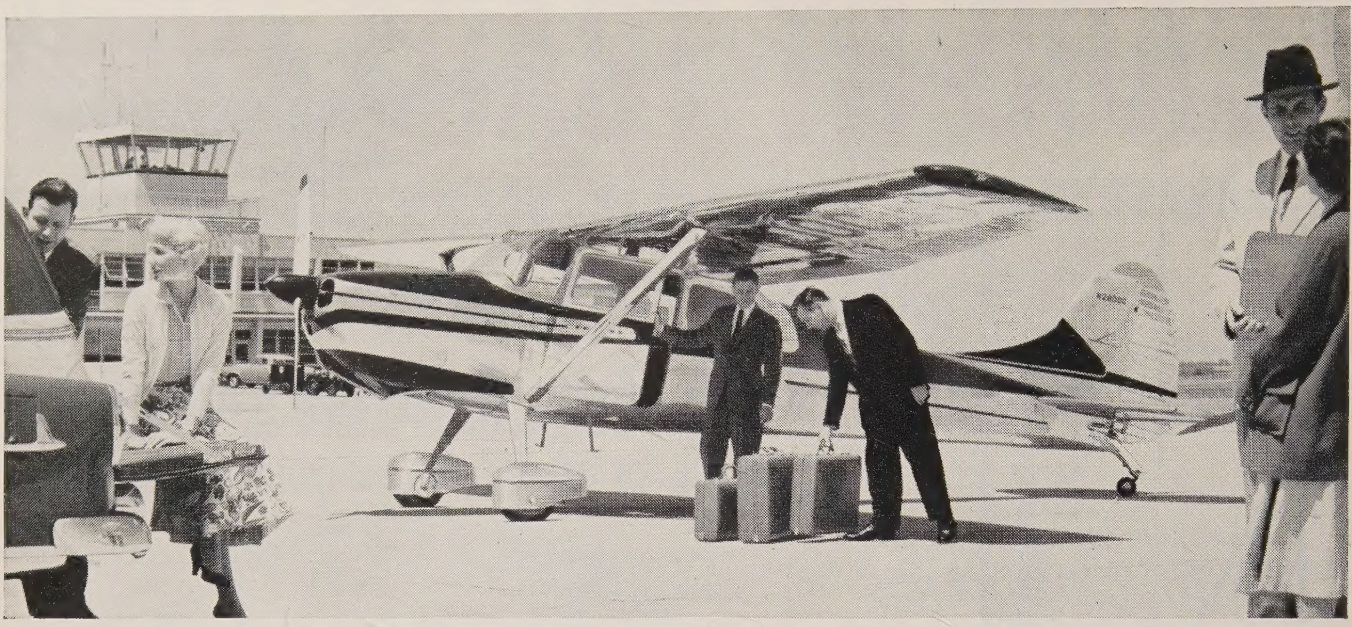

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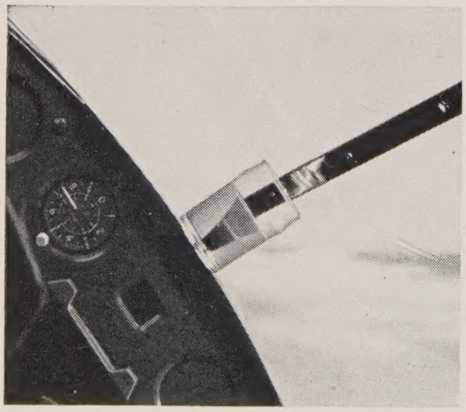

Even in a 60-degree bank, the glass of water placed atop the Cessna instrument panel doesn't vibrate or slide off. Reasons: Cessna's smooth, dependable 6-cylinder engine; Cessna's stable high-wing design; Cessna needle-point control bearings for quick, smooth control handling. Features that add up to smooth, comfortable, effortless flying.

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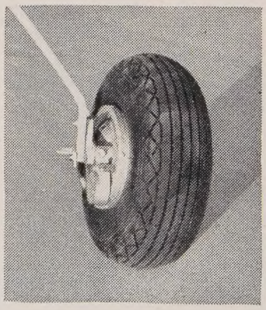
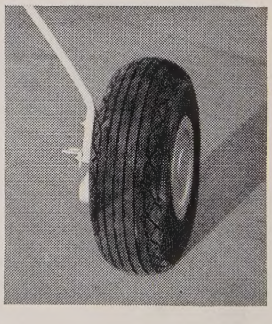
New Positive-steering tail wheel and famous Goodyear castering wheels (opt. now for only $245) let you land, taxi and turn the 170 more easily, safely than any airplane in its class. Wheels pivot to parallel runway even when gusts alter direction of airplane. Makes cross-wind strips easy to use.





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CESSNA 170 180 195 310 THE COMPLETE AIR FLEET FOR EVERY BUSINESS NEED!

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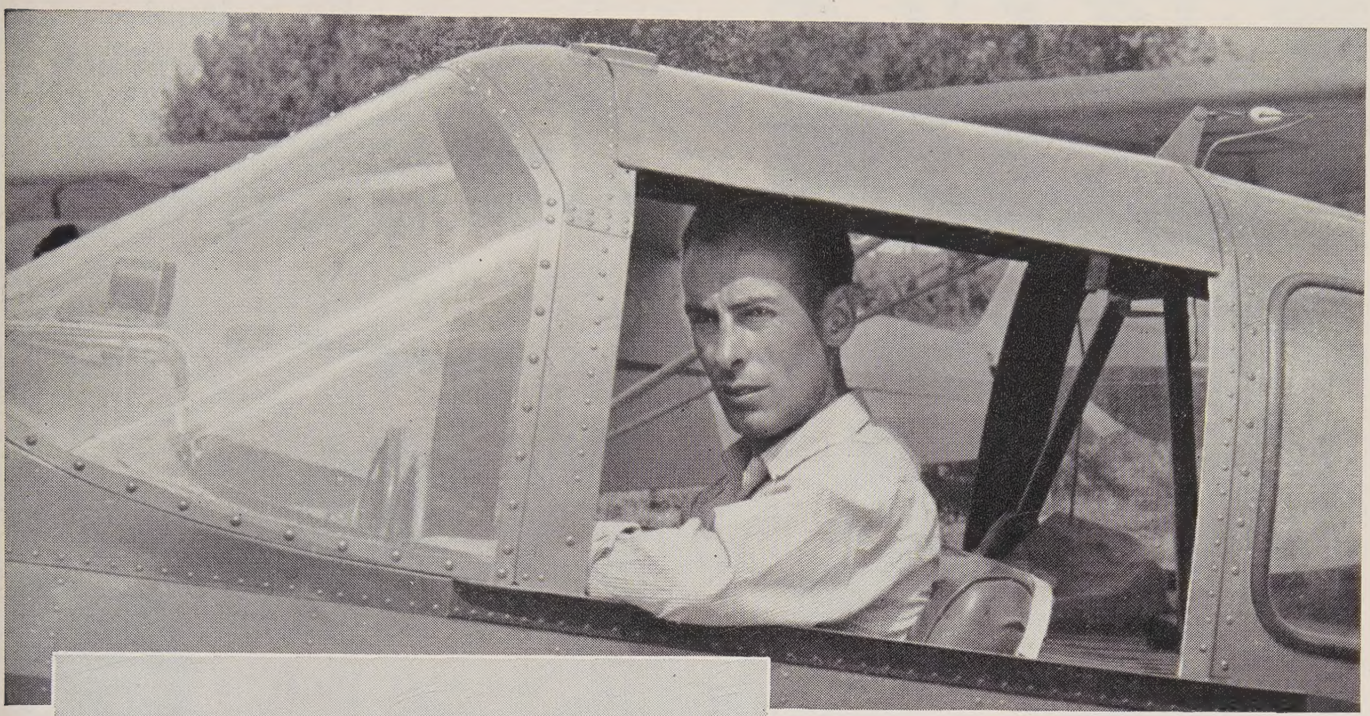

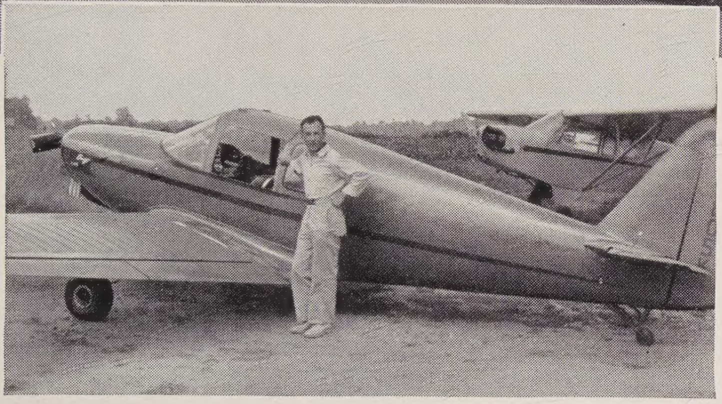

Mr. Jenkins, shown here with a Swift 125, has been flying as a crop-duster and student instructor for nearly 19 years.

ask **Joe C. Jenkins,** crop-duster and student instructor Wyoming, Delaware

Mr. Jenkins says, "Quality aviation products are a *must* in my business, particularly with so much low altitude flying necessary for crop-dusting. I find that no other aviation oil, at any price, gives me the performance and protection of Gulf's top-quality oils.

"And when it comes to *fuels*, I think *Micronic Filtration* and Gulf Aviation Gasoline make an unbeatable combination for safe, efficient flying."

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AND Gulf Aviation Gasoline . . . comes to you "refinery clean"—for your safety—from pumps with advanced *Micronic Filters.*

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Fly to the 34th annual Astoria Regatta for four days of sailboat racing, salmon fishing and other water sports, August 18-21. Plan to land at nearby Clatsop County Airport, Oregon, for quality Standard Aviation Products and service.

Air-lifting phone poles into the mountains

Flying skyhooks! That's what ground crews call James Ricklefs' helicopters that nose up to canyon walls and hover inside rocky gullies, delivering poles along a new telephone route in rugged Southern California mountains. These 'copters also string rope from pole to pole, 5000 feet at a time, so telephone men can pull wires into position without carrying them over the ground.

One of the largest helicopter companies in the nation, Rick Helicopters, Inc., uses Chevron Aviation Gasoline and RPM Aviation Oil to get extra flying hours from all their engines, Franklin 200 h.p. opposed sixes. "Our engines always run at 3100 rpm, putting out full power," says Charles Marthens, Mr. Ricklefs' general manager. "We're getting 600 to 800 hours between majors now, and in our tough service that equals 1200 to 1600 hours of light plane operation. RPM Aviation Oil keeps them running smooth and free, whether we're making take-offs at 10,000 feet in Alaska or fighting forest fires in the States. We'd never use anything else."

T. M'S "RPM," "CHEVRON," "PLANE FAX," REG. U. S. PAT. OFF.

TIP OF THE MONTH

From the air, most towns look pretty much alike. In the seven western states, though, you can check your bearings from the rooftop town signs on nearly 500 Standard of California plants.

CHEVRON AVIATION GASOLINE

RPM AVIATION OIL

STANDARD OIL COMPANY OF CALIFORNIA

SKYWAYS is published by the Henry Publishing Co., 50 Emmett Street, Bristol, Conn. Accepted as controlled Circulation publication at Bristol, Conn.

The kind of alphabet soup no private aviator likes!

(you'll never find it on our menu!)

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And let there be no doubt about the quality of the products they sell!

For example: we supply them with complete stocks of time-proved Goodyear Aviation Products—including the famed tires, tubes, wheels and brakes that have long been first choice as *original equipment* on such popular private and corporate aircraft as Cessna, Beech and Aero Commander.

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Look to the local fixed-base operator who flies the Goodyear **"Sign of Service!"**

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now hear this . . .

PERSONNEL

Harold L. Pearson has been elected president of the Air Transport Association of America.

Col. Robert J. Murphy (USAF-Ret) recently was appointed assistant to the president of Metal-Cal, of Inglewood, Calif.

John B. Montgomery was elected assistant vice president—operations, American Airlines. Until very recently he was Maj. Gen. commanding the Eighth Air Force. **Eugene C. Taylor** was elected assistant vice president—customer service.

John R. Moore and **Dr. Robert M. Ashby** have been named director and assistant director of North American Aviation's Electro-Mechanical Engineering Dept.

Dr. Lloyd R. Zumwalt was elected operations vice president of Nuclear Science and Engineering Corp., a subsidiary of Norden-Ketay Corporation.

Alexander H. Flax has been named assistant director of Cornell Aeronautical Laboratory. **Dr. Mark Foster** has been assigned to the staff of the director's office, and **Harold Cheilek** has assumed leadership of Cornell Lab's Aero-Mechanics Dept. **Robert Kluge** has been named head of Weapons System Design Dept., and **Edward E. Foster** has been named to set up a department designated Engineering Design and Shops to continue services formerly provided under the now-dissolved Development Division.

Earl R. Uhlig has been elected vice president—finance, of the Martin Company.

Irving H. Taylor has joined the Aircraft Industries Association as associate director of export service.

W. T. Noll was appointed director of manufacturing for Aeronautical Division of Minneapolis-Honeywell Regulator Co.

August Bringewald has been named manufacturing engineer for the Republic Aviation F-105 project. **Richard E. Stegler** was named to succeed Mr. Bringewald as chief of manufacturing research and development.

B. H. Tumey recently was appointed Controller of Trans World Airlines, Inc.

Ralph F. Link has joined the Air Transport Association's Air Navigation Traffic Control Division.

W. H. P. Drummond has been promoted to assistant director—engineering, Douglas Aircraft, **E. T. Bush** was named assistant director—field and lab operations; **J. F. Martin** has become assistant director—flight, and **B. A. Foulds,** chief pilot, Douglas Aircraft's Test Division. **M. K. Oleson,** former DC-3 project engineer, was named project engineer for DC-8.

Edward P. Gebhard has been named technical director of Defense Products Division of The M. W. Kellogg Co.

John Brophy was appointed manager—aviation sales of Federal Telephone and Radio Co., a division of IT&T.

Kent M. Campbell has been appointed assistant manager of Convair's Dayton, Ohio, office.

Robert F. Jones has joined TEMCO Aircraft Corporation as executive assistant to I. Nevin Palley, vice-president—engr.

(*Continued on page* 10)

AUGUST, 1955

Skyways

The Magazine of Flight Operations

COVER: Morane-Saulzier 760, a four-place twin-jet executive transport.

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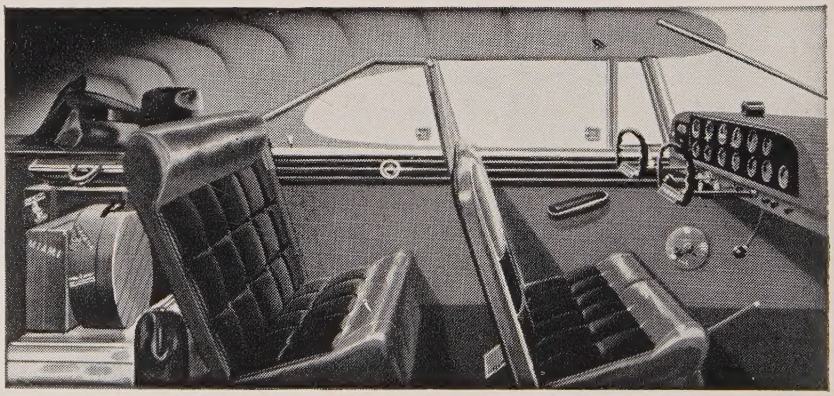

PERFORMANCE PLUS! Now with 150 horsepower, the Tri-Pacer 150 has remarkable short field ability, wonderful rate of climb and cruises 132 mph at optimum altitude of 7000 feet.

You get all this for far less cost than any other production 4-place plane. See and fly the Tri-Pacer 150 at your Piper Dealer's and ask him about the Piper "Learn-as-You-Travel" program or write Piper Aircraft Corporation, Lock Haven, Pennsylvania, Department K-8.

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LOCK HAVEN, PENNSYLVANIA

now hear this

Otis R. Lail, Jr. has been made a special representative for airport lighting by Sylvania Electric Products Inc.

James Mills, Jr., was named Aero *Commander* sales manager for L. B. Smith Aircraft Corp.

E. Harold Kiltie was appointed chief pilot of Riddle Airlines.

Donald L. Fowler is now midwest sales engineer for Aircraft Division of Kawneer.

James W. Salassi has been appointed aviation sales engineer to cover the West Coast for AC Spark Plug Division of GM.

HONORS

E. H. Heinemann, chief engineer of Douglas Aircraft's El Segundo Division, received a Paul Tissandier Diploma for his contributions to aviation. Presentation was made in Paris.

W. A. Patterson, president of United Air Lines, was elected chairman of the Industry Advisory Committee of Flight Safety Foundation, for the year 1955. **William Littlewood,** vice president of American Airlines, was elected vice chairman.

Leonard S. Hobbs, vice president—engineering, United Aircraft Corporation, received the honorary degree of Doctor of Laws from Texas A & M College.

Jerome Lederer, managing director of Flight Safety Foundation was presented a scroll of the Air Transport Pilots Code by the Military Air Transport Command, as an acknowledgement of his contributions to the aviation industry and to MATS.

COMPANIES

American Airlines has placed a $65 million order with Lockheed for 35 four-engine turbo-prop transports, the Lockheed *Electra.* Deliveries will begin in 1958 and continue through the middle of 1959.

Central Aero Supply, a subsidiary of Airwork Corp., has moved from the Woodbury Airport, Woodbury, N. J., to the North Philadelphia Airport, Philadelphia.

Neo-Flasher Manufacturing Co., formerly known as Light Products, Inc., has moved into its new plant in Burbank, Calif.

United Air Lines has ordered three additional electronic flight simulators from the Electronics Division of Curtiss-Wright Corp. Two will "fly" like DC-6B aircraft, the third like a Convair 340.

Solar Aircraft has received a $2,300,000 order from Wright Aeronautical for afterburners and other components for turbojet.

AERO CALENDAR

Aug. 5-7—Third Annual "Fly-In," Experimental Aircraft Association, Curtis-Wright Airport, Milwaukee, Wis.

Aug. 10-14—Air Force Association convention and Air Power show, San Francisco.

Aug. 19-21—Second Annual "Fly-In," Antique Airplane Assn., Ottumwa, Iowa.

Sept. 21—Southwest Airmotive Engine Forum, by Pratt & Whitney and Bendix, Melrose Hotel, Dallas, Tex.

Oct. 7—Symposium on "Escape from High-Performance Aircraft," IAS Bldg., L. A.

Oct. 8-15—7th Annual Texas Air Tour.

Oct. 26-28—Southeastern Airport Managers Assn., annual meeting, Poinsett Hotel, Greenville, S. C.

industry notes . . . . .

■ Pan American World Airways has purchased $2 million worth of RCA AVQ-10 airborne radar to equip its fleet of long-range DC-6's and DC-7's. The decision to buy the radar came after the equipment had been put through an extensive series of tests under all kinds of weather conditions on Pan Am's flights to Europe and South America. More than 2,000 actual flying hours were logged. The RCA AVQ-10 operates on the C-band at 5.7 cm.

■ Cessna Aircraft has approved the Safe Flight Instrument Corporation's Speed Control System as optional equipment factory-installed for the 170 and 180 as well as the twin-engine 310. The Speed Control System is a simple computer compensating for a variety of flight variables such as power, gross weight, flap and gear position, turning and longitudinal accelerations, ground effect and density altitude. It enables the pilot to get the best speed for take-off, landing and low-speed operations.

■ Convair recently received an Air Force contract calling for the conversion of a fleet of 36 C-54 transports into air rescue craft. The converted 54's will be designated SC-54's and will be used by the Air Rescue Service of MATS. The first is scheduled for delivery to the Air Force in the fall. Conversion work is being done at Convair's Fort Worth plant.

■ Capital Airlines expects to begin *Viscount* service between Washington and Chicago this month (July). Three round-trip flights will be made daily and a round trip between Washington and Norfolk also will be operated. As additional *Viscounts* are delivered, service will be extended to other cities on Capital's system. A fleet of 60 turboprop *Viscounts* has been on order for several months.

■ The U.S. Navy has purchased four De Havilland *Otters* for work in the Antarctic. Designed for freighting and utility duties under severe conditions, the *Otters* will operate into the heart of the polar continent, flying men, equipment, dog teams and stores, and will do reconnaissance work as well. The *Otter* is powered by 600-hp Pratt & Whitney *Wasp* engine and offers excellent take-off and climb performance with a full load. It carries either a ton of cargo or up to 14 passengers.

■ Late in October or early in November, Trans World Airlines expects to begin transferring its maintenance operations from Fairfax Airport to Mid-Continent International Airport, some 15 miles northwest of Kansas City. TWA's new base will relieve overcrowded conditions and provide for even greater expansion. Said to be the world's most efficient aircraft-overhaul base, TWA's new headquarters are the result of two years of study and planning.

■ Forney Industries at Fort Collins, Colo., have purchased the manufacturing rights, type certificates, tooling jigs, etc., of the two-place Ercoupe, formerly manufactured by Erco and Sanders Aviation. Aircraft parts are already in production at the Forney Fort Collins plant and the Ercoupe itself is expected to be back in production in a year or so.

■ Bell Aircraft's helicopter division at Fort Worth recently was awarded a contract to build 21 Army H-13H helicopters. A more powerful version of the H-13G, the H-13H is powered by a 250-hp Lycoming engine. All 21 of the copters are to be equipped with radios, dual controls, winterization kits, litters and night-flying equipment. Deliveries are expected to begin in June, 1956.

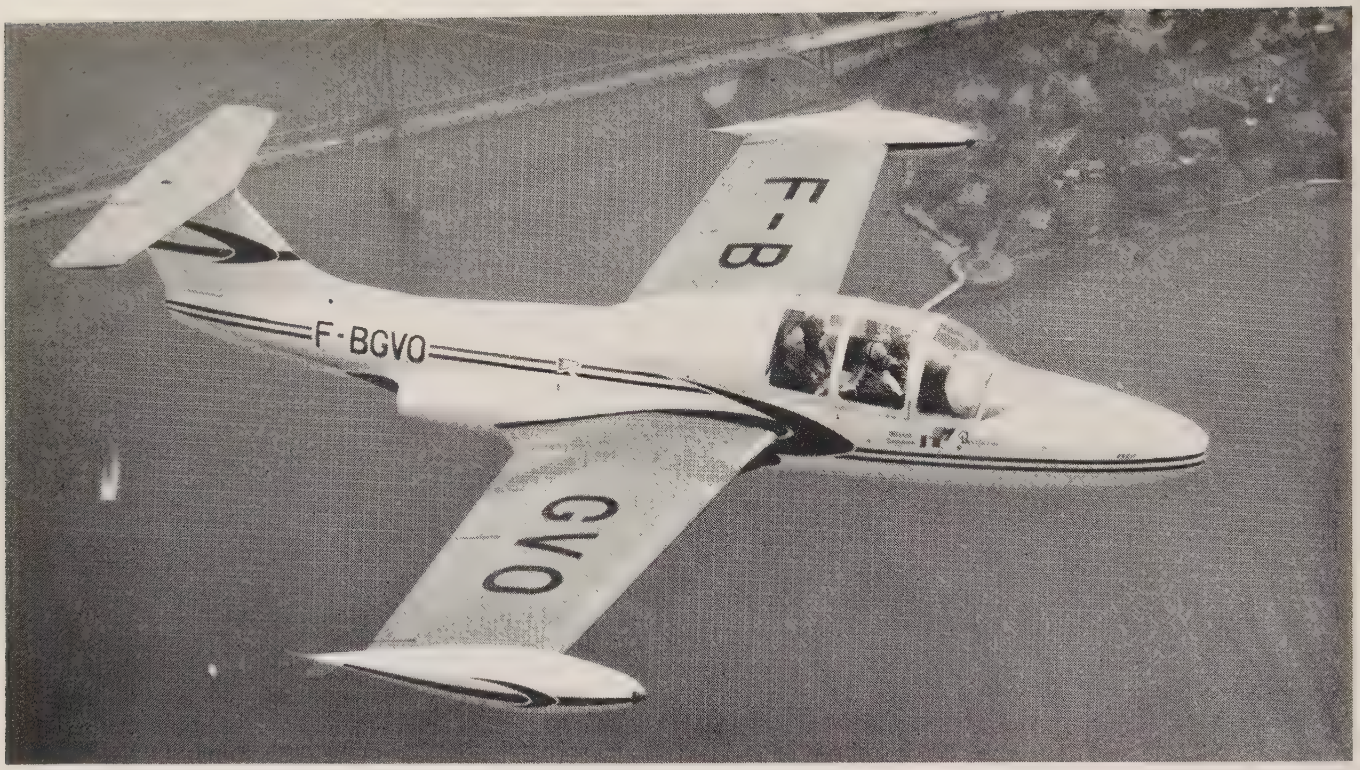
■ Fairchild Aircraft has been awarded a new USAF contract for the production of 73 more C-123B assault transports. This new contract brings to nearly 240 the number of C-123's slated for production.

■ El Al Israel Airlines has signed a contract for purchase of three turboprop *Britannia* Mark 300LR airliners. Powered by four *Proteus* 755 turboprop engines, the *Brittania* has a top cruising speed of 389 mph and a maximum range with full tanks plus payload of 6100 miles. El Al Israel Airlines expects to have the *Britannias* in service sometime early in 1957.

■ Three remote-controlled runway crash barriers have been put into operation at the Republic Aviation Airport. The new "jet traps" of nylon, canvas, steel cable and anchor chain are able to halt a *Thunderstreak* jet fighter-bomber or a *Thunderflash* reconnaissance plane making an emergency landing. These safety devices will prevent any of the jets from speeding off the end of the runway. Grumman Aircraft has employed a hook and cable "stop" arrangement on its airport for some time, and with excellent results.

■ First production model of the Convair F-102A, supersonic all-weather interceptor, was delivered to the U.S. Air Force recently. The F-102A's delta wing has upswept tips and its leading edges are cambered. The fuselage is longer than earlier models, and it is powered by the Pratt & Whitney J-57 jet engine.

■ Beechcraft recently delivered the first two T-34B's scheduled for use in the Navy's newly revised naval aviation cadet training program. Powered by 225-hp Continental engine, the Navy T-34B has a top speed of 190 mph. The two 34B's are the first of a substantial quantity ordered by the Navy to replace the SNJ trainers now in use.



MORANE-SAULNIER 760, *a four-place twin-jet executive transport, is presently on demonstration tour in the U.S. Easy to handle and very maneuverable, the MS 760 may be produced in this country by Beech Aircraft. The 760 is about the size of the Bonanza*

Executive Pilot's Report: MS 760

by Herb Fisher

Chief, Aviation Development Division

The Port of New York Authority

The era of the jet-powered business aircraft has not yet arrived but undoubtedly it is just over the horizon. And recognizing that this form of propulsion offers definite advantages for business and industry as well as for air carriers, Beech Aircraft Corporation and the Morane-Saulnier Company of France have teamed up to give us a preview of what the first jet entry in this field probably will look—and act—like.

In its present configuration, the Beech & MS executive transport is a four-place, twin-jet, pressurized, air-conditioned, low-wing job with the rakish lines of a military fighter. Its range, with allowances for climb-out and let-down but no reserve, is 875 miles at 20,000 feet and a cruising speed of 350 mph. The maximum range is 970 miles at 23,000 feet at 90% (20,000 rpm) of rated power.

These performance figures apply to the French-designed aircraft—it is called, appropriately, the *Paris*—at maximum gross weight of 7,480 pounds. The load factor, with four persons, baggage and full main tanks, is 10.

The powerplant installed in the No. 1 airplane, now on a nation-wide demonstration tour of Beech distributors, is the Turbomeca *Marbore* Series II type with a sea-level static thrust rating of 880 pounds at 22,600 rpm. However, any American production model of the *Paris* will carry the Continental Motors' modification of the *Marbore*, which will be rated at 920 pounds of thrust. Continental expects to increase the power without increasing substantially the rate of fuel consumption or over-all weight. The American version of the *Marbore* is designated the J69 and is now being produced for use in several American military projects.

It was my good fortune to be the first pilot outside the Beech and Morane-Saulnier organizations to fly the new twin-jet after it was assembled and tested in the East in preparation for the "first-look" tour of the country. It was rolled out for my inspection by Leddy Greever, Beech sales manager; G. Allan Raines, Beech sales engineer and pilot; W. E. Richards, vice president in charge of Atlantic Aviation's Teterboro, N. J. operation; and Gene Larimer, Atlantic's sales manager. Atlantic was the first Beech distributor to demonstrate the MS 760 in the U. S.

My coach in the cockpit was Jean Cliquet, the pilot assigned by Morane-Saulnier to shepherd the *Paris* around under the critical eyes of *les Americaines dans les Etats-Unis.* One of his problems is the language barrier but, despite some of the atrocious French tossed at him by us American throttle-jockies, he managed to understand us. However, I can report that *il parle bien l'Anglais.* And he is an excellent pilot who flies the airplane well.

Aerodynamically, the T-tail aircraft is clean and lean and, in view of the fact that it has only 1,760 pounds of thrust, its performance is remarkably good. It has a

take-off distance, at the T/O speed of 105 mph, of 2500 feet with another 1,550 feet needed to meet the 50-foot obstacle take-off requirement. That speed, of course, provides for single-engine safety on take-off. Landing roll is 1,850 feet and landing distance over a 50-foot obstacle is 3,050 feet. It is not, therefore, a short-airport aircraft like, say, some of the twin-engine (piston) equipment now used in the U. S.

However, and this is important in high-density areas where take-off procedures are important to noise-control programs, the MS 760 can out-climb any Twin equipped with reciprocating engines. Its rate of climb performance (two engines at 22,600 rpm) is as follows: 2,260 fpm at sea level, 1,600 fpm at 10,000 feet, and 1,000 fpm at 20,000 feet. Its single-engine rate of climb (22,600 rpm) is 600 fpm at sea level. It is important to note here that, although the performance chart released by Beech lists the single-engine ceiling at 9,000 feet, the MS 760 can maintain altitude on one engine at, say, 20,000 feet. Service ceiling with normal power is 34,400 feet and the absolute ceiling is 36,000 feet.

Substitution of the Continental J69 for the present *Marbore* Series II engine would revise the MS 760 performance figures upward as follows:

Cruising speed and range at 21,000 rpm (normal): 550 miles at 355 mph at sea level; 710 miles at 10,000 feet at 360 mph; and 915 miles at 355 mph at 20,000 feet. Maximum range at 23,000 feet at 20,000 rpm would be 1,015 miles, or an endurance of 3.35 hours at 303 mph.

The higher powered J69 would make possible an increase in service ceiling to 35,500 feet and a rise to 10,000 feet in the single-engine ceiling. Maximum speed would be pushed up to 410 mph.

The engine uses a single-stage centrifugal compressor and a single-stage nozzle. Fuel is introduced into a rotating hollow shaft and is slung out into the combustor chamber and burned. The need for a fuel system of extremely high pressure is unnecessary, because the high speed of the rotating shaft provides for excellent atomization and burning. Another important feature of the *Marbore* is that it does not require some of the critical materials ordinarily used in the high-temperature components of turbines. The Continental J69, with about 4% more thrust than the French engine, makes provision for American accessories of a larger type than now used on the *Marbore.*

The aircraft has a minimum stalling speed of 95 mph and I found that it has good stall recovery performance. When Cliquet cut one engine on me at about 9,000 feet, I noted that yawing was almost imperceptible.

The dive brakes, which extend from the top and bottom of the wings, come in handy in the traffic pattern and give one a fast-acting drag control for in-flight maneuvers which is necessary on high-performance aircraft. Unlike military aircraft that require immediate retrimming when the dive brakes are popped, the MS 760 quickly slows down and no retrim is necessary.

Since the decibel rating of jets is such an important consideration, particularly in such highly populated areas as New York and Chicago, I spent a lot of time just listening to the MS 760. It is my opinion that the sound level of this little jet aircraft is somewhat less than that of the Convair on take-off. The screech is most noticeable while it is taxiing, generating a piercing, high-pitch whine which is one of the characteristics of a turbine engine.

I was also concerned wth the internal sound level of the MS 760. I believe, and others who have flown and ridden in the aircraft share my conclusion, that it would have to be material reduced in any production model. Normal conversation is possible at all times in the airplane, but there is a continuous metallic scream seeping in from the engines buried in the fuselage.

With the sliding canopy and the seats forward of the leading edge of the wings, the visibility of the aircraft is better than any other four-placer. And the canopy is equipped with four accordion-type shades, one over each seat, to reduce glare to a minimum.

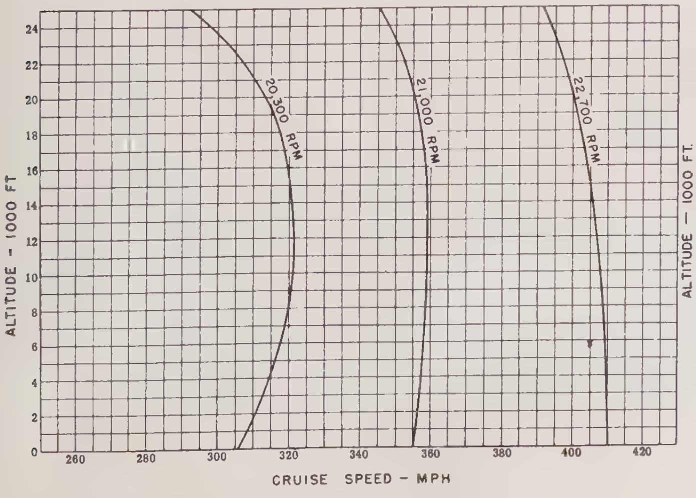
Its interior dimensions are comparable to the Beech E-35 *Bonanza.* The E-35's interior length exceeds the MS 760 by 18 inches, 83 to 65, but the MS 760 cabin is wider by four inches. Cabin heights of the two airplanes are almost identical. The MS has the higher payload, 805 pounds to 797 pounds.

In its present configuration, the little French craft does not have the range demanded by most users of business aircraft. Its maximum range of 970 miles is well below the 1500 range the business user considers an absolute minimum for the twin-engine category.

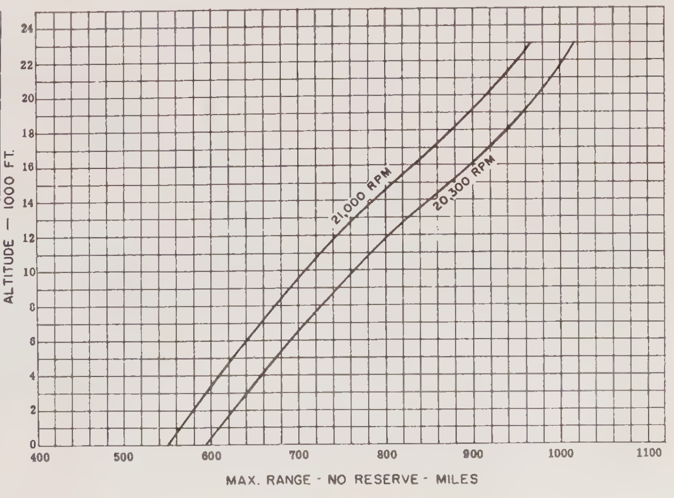
The fact that Beech has announced it is adding the French-designed twin-jet to its line of executive transports is assurance, I believe, that when the production go-ahead is given, the fly-away job at Wichita will have been modified to meet the business users' most exacting requirements. That includes satisfactory range, sound level and price.

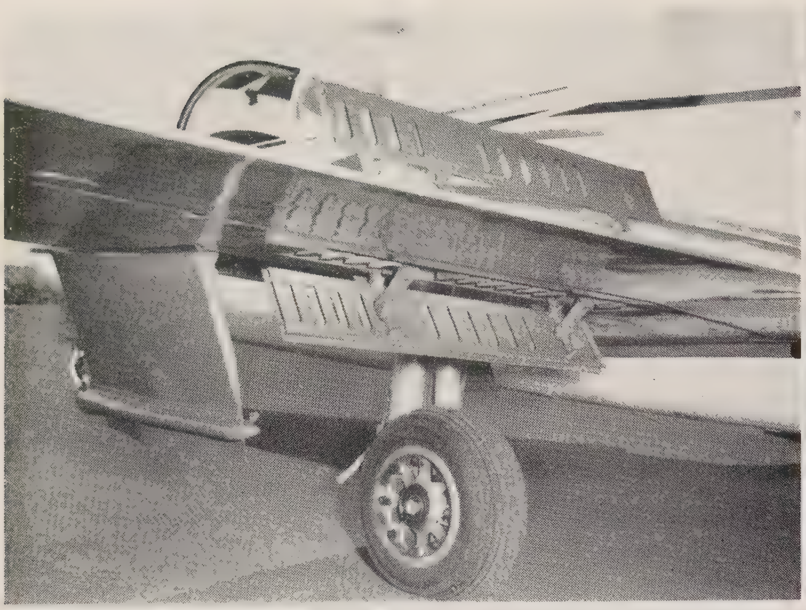
The wing span of the MS 760, which is an easy plane to enter and leave, is 33.3 feet and wing area is 194 square feet. The wing loading of 38 pounds per square foot is comparatively high. Its length is 32.9 feet and maximum

CRUISING OPERATION CHART
AT 7480 LBS



CRUISING RANGE — WITH TIP-TANKS
GROSS WEIGHT - INCLUDING CLIMB AND DESCENT





DIVE BRAKES, *electrically operated, extend from top and bottom of the wings. Unlike military jets, when brakes are popped, the 760 needs no retrimming*

SKYWAYS' *Flight Evaluation Editor Herb Fisher with Beech Pilot Al Raines (right) check wing-tip tanks*

height to the top of the stabilizer is 8.5 feet. Empty weight of the airplane is 4,325 pounds. Oil and fuel, 2,350 pounds, is carried directly back of the rear seat.

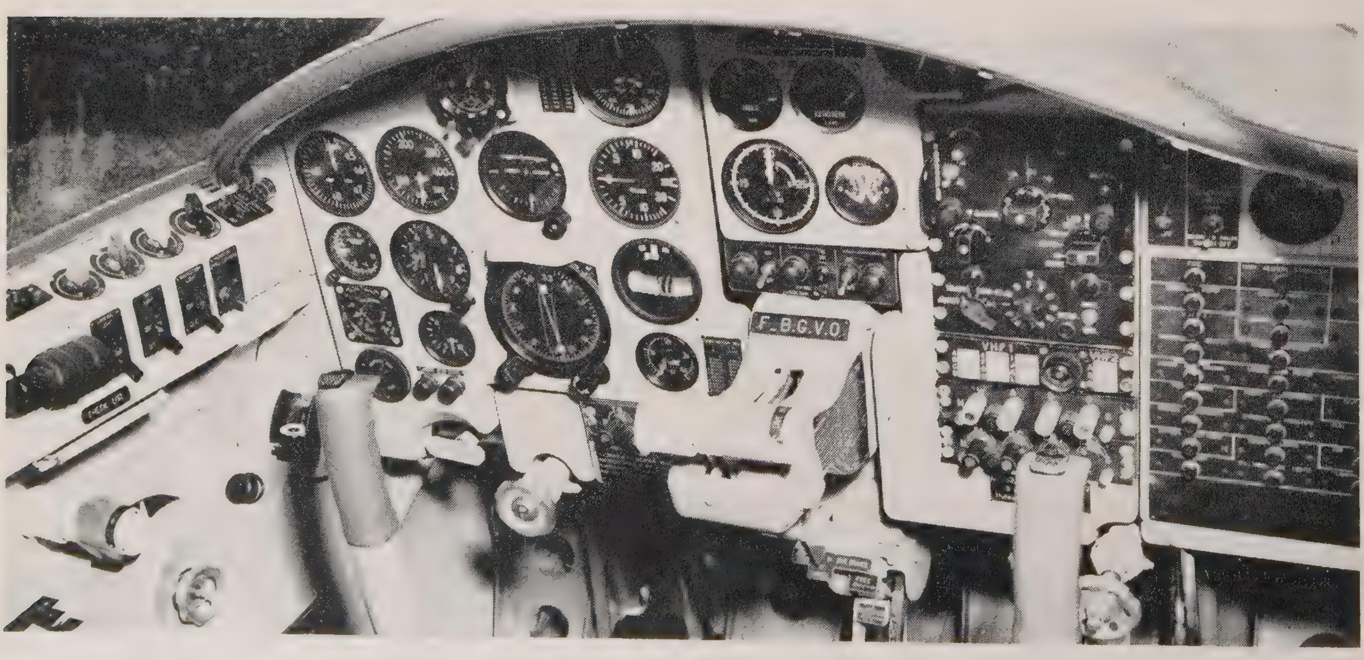
The French paid close attention to maintenance features and everything is easy to get at. The entire rear section of the fuselage and the tail can be removed in a matter of minutes. A French crew of four recently made a complete double engine change in about one hour.

In all my years of flying, including jet experience, I can't recall a small aircraft easier to handle or more maneuverable. The MS 760 gave me the feeling that I had a very substantial and high-performance aircraft at my command. Al Raines, Beech sales pilot and former Air Force jet pilot with the big smile, whom I got to know well while he was in New York, is to be envied his opportunity to demonstrate the aircraft around the country.

Beech is not certain what its version of the airplane will cost, but the figure probably will be a minimum of $250,000. With pressurization and air-conditioning, the price tag doubtless would be above $300,000. Whether the price finally arrived at will be too high to stop the prospects who can use this type of transportation is problematical. Beech believes it will not.

A few years ago there was general agreement among spokesmen for the businss aircraft fraternity that there was no market for a pure jet or a turboprop executive transport in the foreseeable future. At the same time, there was a growing demand for business-type aircraft with cruising speed of 300 mph or more.

The French have demonstrated, through development of the MS 760, that perhaps the day of the jet business aircraft is much closer than most of us realized. Beech Aircraft, with its working agreement with Morane-Saulnier, is taking the initiative in helping executive transportation take its next big step forward.



CABIN *of the 760 is comfortable and its instrument and controls set-up is conducive to easy flying. Dive brake control is on the handle of the throttle of right engine; trim and aileron controls are on the stick. Engines are Continental-built Marbores*

Lear Autopilot-Navigator

by Harry G. Graybill

For a number of years there has been a persistent rumor about William P. "Bill" Lear, board chairman and director of research and development of Lear, Inc. During these years, Bill often has flown about the country all by himself, in a twin-engine airplane—this because he considers a Lear L-5 autopilot the best possible substitute for a copilot. According to rumor, he puts so much trust in the L-5 that he catches up on his sleep in the cabin, while the airplane drones on hour after hour, unattended save by the L-5.

Bill never has absolutely denied or confirmed this story. His stock answer is simply, "The important thing is that I *can* if I want to!"

He goes on to point out that the L-5 has automatic altitude control—that it has a safety cut-out which, in event of any malfunction or loss of power, automatically disconnects the autopilot system, leaving the airplane perfectly trimmed, and sounds a horn for the pilot's attention —that during off-airways flights over the less congested areas of the country the odds against collision with another aircraft are astronomical.

Yes, there is absolutely no question but that he *can* do it if he wants to.

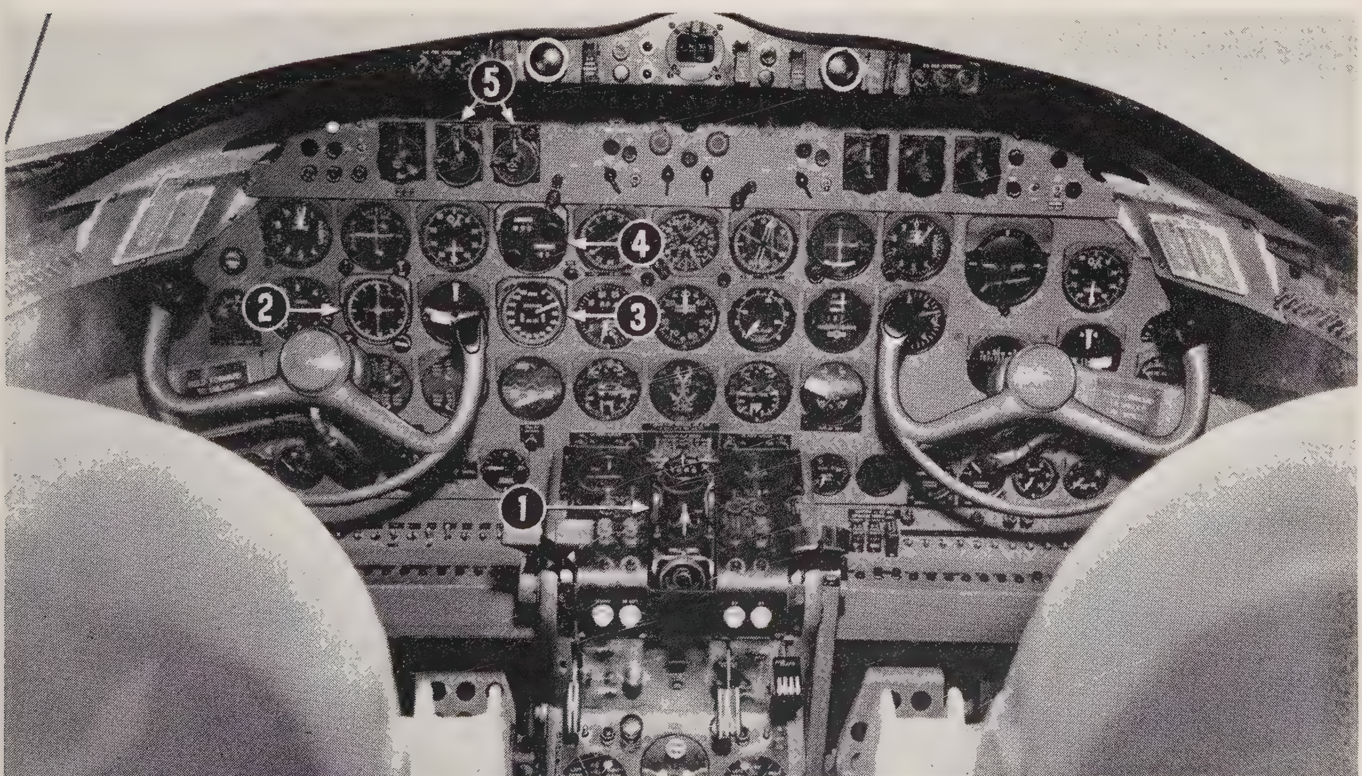
As a matter of fact, applying his latest electronic wizardry, he can do more. He can stick a punched card in a slot, twirl a couple of knobs, and then sleep while his airplane not only flies itself but also flies straight to a preselected destination hundreds of miles away, regardless of changing wind conditions, and even if there is no radio facility at the destination.

An "automatic pilot-navigator" has been born—one that can automatically fly an airplane to a point, at any preselected altitude directly over any of an infinite number of destinations—the Empire State Building, a ranch in Texas, a lake in Canada, a remote airstrip in Idaho. Furthermore, it keeps the human pilot advised at all times as to how far ahead his destination is and lets him know the exact moment he arrives over it.

This remarkable installation, perfected by Lear Aircraft Engineering Division, at Santa Monica, is being incorporated in *Learstar* executive airplanes now in quantity production. Much credit must go to the engineers and technicians of Lear AED's Electronics Division.

This electronic brain-trust achieved this near approach to fully automatic flight through the marriage of two highly engineered and field-tested systems, the Lear L-5 autopilot and navigational coupler system and the Collins NC-101 navigation computer system. The result of this happy union is a tireless crew member who reads gyro instruments with superhuman vigilance and accuracy, whose handling of the controls is incredibly smooth and precise, and who in the meantime, without ever turning away from instruments or controls, can accomplish continuous triangulation computations, maintain a running fix, constantly compare position with predetermined

(*Continued on page* 36)



INSTRUMENT PANEL *of the "automatic" Learstar features (1) the autopilot controller, (2) the course selector and indicator, (3) the distance indicator, (4) the waypoint selector, and (5) two VOR receiver control heads. Weight of the whole system is 173 lbs*

ADDITIVES *in aviation fuels and lubricants was subject of the Flight Operations Round Table at the Wings Club, New York. Participants were (left to right around table) Frank D. Klein of Esso Standard Oil Co., W. S. Little, Jr., of Shell Oil Co., John R. Griffin, Jr., of E. I. DuPont de Nemours & Co., Inc., Karl Hess, Fuels and Oils' editor who served as moderator of the discussion, William B. Harper of American Petroleum Institute, D. B. Dolan of the Gulf Oil Corp., and Joe Chase of Flight Safety Foundation*

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Additives in Fuels and Lubricants

Moderator Karl Hess (*Fuels & Oils Editor*): "We are here today to discuss additives in aviation fuels and oils, and the advantages and disadvantages that may be involved in their use. Certainly, everyone is aware of the extensive application of additives in automobile fuels and oils, and even broader horizons are being opened up in additive applications in the aviation field.

"The ones we will discuss are those added to basic petroleum fuels or lubricants by the manufacturer at his refinery. They are results of months and years of experimental and widespread field service testing to find optimum materials which the manufacturer believes will result in a product which will serve his customers better than any combination.

"Service and competition, in this most competitive of all the nation's great industries, go together. We know that each time a manufacturer places a new additive in service, it is the result of the most serious consideration of all competing products, and represents the manufacturer's stake, you might say, in the future.

"We will not spend time in this discussion on the more than 250 patent-medicine type additives which promise advantages to the user regardless of the type of fuel or lubricant he is using. Such additives are caught up in a maze of variables that scarcely could be untangled by all of us put together. The patent-medicine types are those added to already compounded fuels or lubricants at the point of use, and added by the customer. You might call it personal research, tank-full by tank-full. Certainly, it involves the personal responsibility of the person trying it and not the maker of fuel who sets his specifications at the refinery.

"We realize, too, that millions of dollars are being spent each month by the petroleum industry to improve their products. Because of that, the experiences cited here can only be a prologue to a discovery tomorrow which may make today's information as obsolete as 73 octane aviation gasoline.

"We are fortunate to have representatives of fuel and additive makers with us whose experiences and know-how are among the best in the business. Esso, our largest producer, has racked up millions of barrels of special know-how. DuPont gives us the chemical basis of our additives. Gulf has been a pioneer in detergent aviation oil. Flight Safety Foundation, has helped us learn to use all fuels more safely. We also have with us a representative of American Petroleum Institute, and we are all aware of the immense value of API's basic researches in fuel developments.

"*Shell Oil also has been a pioneer in working with additives, for example, TCP, and I think we might lead off the discussion with comments by Mr. Little.*"

"*Would you give us some of the background on additives, Mr. Little, and what has been achieved to date?*"

W. S. Little, Jr. (*Technical Representative—Aviation Dept., Shell Oil Co.*): "To begin with, we should consider the over-all supply position of aviation fuels and what dictated the need for probably the first additive, tetraethyl lead. The availability of aviation fuel hinges today on the use of tetraethyl lead, and without that

additive the petroleum industry certainly would not produce the quantities of high-performance fuel needed by the airlines and the military.

"Stemming from the use of tetraethyl lead is the phenomenon of spark plug fouling which, we believe, is due to the deposition of metallic lead on the plugs. Recognizing that fact, Shell developed TCP which reduces the malfunctioning of spark plugs because of the lead deposits.

"Through the years of testing TCP, we have demonstrated that in both military and short-haul carrier operations, in both long-range cruise and where there are frequent take-offs or in crop-dusting, TCP can materially reduce the spark plug fouling."

Karl Hess: "*Apparently, this is a case of one additive leading to a problem that is solved by another additive. Must we presume that every additive we might get would present some sort of a problem that would generate still another one?*"

Frank D. Klein (*Aviation Group Head, Esso Standard Oil Co.*): "This is often true. When you add a rust inhibitor to a product, you usually cut down its oxidation stability to where it was in the first place. When you put extreme pressure agents in a lubricant, you often have to add something else to offset the corrosive tendencies of some of those agents.

"I'm not saying this to run down additives, but it is a fact that you often do have to add another substance to counteract possibly an undesirable result of having used an additive."

Karl Hess: "*How is Esso approaching the problem of additives? For example, what are you doing with aviation fuels?*"

Frank Klein: "Normally, we do not use TCP in aviation fuels. We can furnish it when the consumer requests it, but thus far we have not had much demand for it. There are special cases where TCP might be beneficial, for helicopter operations or crop dusting, but for the most part we do not feel that TCP has proved of value in general aviation use. In fact, it often causes trouble. However, we don't hesitate to admit it has proved beneficial in special cases, and for those cases we would recommend it."

Karl Hess: "*What sort of trouble could an additive cause?*"

W. S. Little, Jr.: "It's quite widely known that under certain conditions in airline operation the exhaust gas temperatures are such that an additive like TCP tends to give abnormal deposits in the exhaust systems of the R-4360 and the turbo-compound R-3350 engines. Aside from those two, however, I don't believe anyone in aviation has discovered any abnormal effect in the use of TCP."

Karl Hess: "*Then you would agree that the answer is the selective use of it?*"

W. S. Little, Jr.: "Without any question, the selective use of an additive such as TCP, combined with specific operating conditions, is the answer. The military summed it up in their recent release of new specifications which call for the use of tricresylphosphate or TCP in aviation fuel, all of which means that they are buying fuel with this additive for their specialized applications."

Karl Hess: "*We've been talking about ordinary aviation gasoline, but what about fuel for jet aircraft?*"

W. S. Little, Jr.: "Actually, there are three types or additives: oxidation inhibitors, additives such as TCP, and corrosion inhibitors."

John R. Griffin, Jr. (*Aviation Consultant, E. I. DuPont de Nemours & Co., Inc.*): "I'd like to point out that all aviation fuel contains additives and that those additives do not necessarily present problems which hinder their use. For example, all fuels contain tetraethyl lead and supplementary material to scavenge that lead from the combustion chamber. Similarly, all aviation gasoline contains additives for oxidation stability to permit the gasoline to be stored without harm.

"With respect to jet fuel, almost all jet fuel used by the military services contains an additive for stability in storage. Other phases are going to become apparent as the jet fuel becomes more widely used by both the military and the commercial operators, but the nature of those problems is not completely known as yet."

Karl Hess: "*Is there any indication of the direction research may go?*"

John Griffin: "In my opinion the direction is clearly marked. The only reason we use turbine powerplants for aircraft is the desire for higher speeds, and in order to make engines efficient they have to operate at higher temperatures. Therefore, all the problems undoubtedly will be associated with the higher temperatures and/or high loading necessary for greater efficiency. That is the direction research will take in adding new factors in the fuel supply."

Karl Hess: "*Mr. Dolan, Gulf certainly has emphasized the use of additives in aviation lubricants. Would you comment on that?*"

D. B. Dolan (*Aviation Representative, Gulf Oil Corp.*): "Gulf has been one of the pioneers in the use of detergents in aircraft lubricants, and we have produced our Gulfpride Aviation Series D which is an aviation-type detergent oil originally designed for use in horizontally-opposed lightplane engines. These engines encountered a certain amount

"**OPERATORS** *who change oil about every 25 hours," reported D. B. Dolan (left, next to Mr. Chase), "are getting the best results"*

"**PERFORMANCE** *imposes certain limits on use of additives," reported John Griffin (left) in response to query by Karl Hess*

of valve and ring difficulty a few years back, and we brought out this particular lubricant to counteract that. The Gulfpride Series D, however, is not what we now consider a high-detergent or HD type oil. It has always been labeled a detergent-dispersant type oil. This aviation-type detergent isn't the same as automobile types, because the engines and type of operation are entirely different and, therefore, the detergent is required to produce results under a different set of conditions. An automobile operates on automobile gasoline along the dirty streets with starts, accelerations, low speeds, frequent stops and changes in throttle and at water-cooling temperatures. The airplane engine operates on an aviation-grade fuel, in relatively clean air (after it leaves the ground), at constant throttle and at higher temperatures permitted by more highly developed, more expansive metals in air-cooled cylinders. To keep these engines free from deposits, free from piston wear and valve sticking and to minimize wear, thereby assuring increased time between overhauls, Gulf brought out its Gulfpride Aviation Series D in 1948. Since then we have changed the detergent to reduce an undesirable combustion-chamber deposit by taking advantage of a newly developed detergent. As improved detergents are developed, we expect to continue this policy.

"We do not recommend Gulfpride Aviation Series D for supercharged radial engines because these engines normally do not have their oil changed often enough to take advantage of the dispersant qualities of this type oil and are more sensitive to combustion-chamber deposits than the unsupercharged horizontal-opposed engine. An improvement in the type of detergent, could easily eliminate this objectionable quality."

Karl Hess: "*Have you run into any problems concerning the handling of oils at airports, perhaps problems brought on by the necessity of keeping the different types of oils separated?*"

D. B. Dolan: "No, we haven't encountered any such problems. The oil is packaged in either quart containers or 55-gallon drums and these are clearly marked. I might add that the 55-gallon drums of Gulfpride Series D now have been eliminated."

Karl Hess: "*Have any of the companies encountered any particular storage problem with either fuel or oil, because of the use of additives?*"

Frank Klein: "The only caution I know of is that many fuels or oils with additives must not be put in galvanized containers."

Joe Chase (*Mgr., Maintenance & Equipment Div., Flight Safety Foundation*): "Does the use of fuel additives work against the co-mingling of fuels? For example, where the purchases of several airlines are served through one system?"

Frank Klein: "The answer to that is that most additive products are required to be compatible with what other companies are using. If a company comes out with a new additive, that company must make sure before it starts putting it out on a large scale that the new additive is compatible with those already in use."

William B. Harper (*Supervisor, Research & Inquiries Section, Dept. of Information, American Petroleum Institute*): "Isn't the problem of compatibility a bigger factor in lubricating oils?"

Frank Klein: "That's been the opinion for years. Actually, it has been the policy of Esso and other companies to discourage the belief that it doesn't matter what different oils with different additives you use. If a plane owner uses your oil, has trouble and then blames your oil, you do your best to locate the cause; if he uses a variety of oils, none of the suppliers could accept responsibility."

Karl Hess: "*Do you think engine specifications should include details of additive content in both lubricants and fuels? I'm speaking now of manufacturers limiting the types of fuels and oils used, with reference to additive content.*"

Frank Klein: "We'd like the engine manufacturers to say nothing about it at all, and leave it up to us to be responsible for what we put into fuel or oil. We expect to take the blame if something goes wrong, and if we are proved to be at fault, we will do something about it."

D. B. Dolan: "Any marketer of fuel or oil has to satisfy the requirements of all engine manufacturers operating throughout the world under all climatic conditions. This means several grades of petroleum products, and their characteristics are decided upon by close and constant cooperation between the research and development laboratories of the petroleum refineries and the engine manufacturers."

John Griffin: "I know of no specifications for fuel and oil (except in the case of TCP) where the form of additives in the fuel are specified. In most cases, only the performance required of each particular product is specified. If the supplier of the product has to use additives to achieve that performance, then it is up to him to make sure all other factors are taken care of."

W. S. Little, Jr.: "We really have two cases here: one is fuel, and the other is oil, and we can't talk generically about either one of them.

"Fuel requirements today are mainly defined by military specifications which must be met, since the military represents the largest user. Restrictive specifications can only work against the ultimate user because he immediately reduces the

"BLENDING *of turbine fuels is acute problem," said W. S. Little (right), "because of the low and high temperature requirements"*

"GULF'S *recommendation to operator of high-performance radial engines," said Mr. Dolan, "would be not to use a detergent oil"*

ROUND TABLE PARTICIPANTS

KARL HESS who served as moderator of the Round Table is a former magazine specialist with American Petroleum Institute. He also is a former editor of Newsweek.

FRANK D. KLEIN, Aviation Group Head for Esso Standard Oil, has held his present position since 1941; was with USAF, 1925 to '39; with Martin Co., from '39 to '41.

JOHN R. GRIFFIN, JR., a specialist in aviation fuels and lubricants, is a graduate engineer. He is a member of SAE, ASME and the Institute of Aeronautical Sciences.

D. B. DOLAN, aviation representative with Gulf Oil Corp., has been associated with the marketing of all types of aviation petroleum products for the past 10 years.

JOE CHASE has been active in aviation since 1929. He spent 12 years with UAL; was with CAA, and before joining FSF, was Mgr., Aviation Dept., Kemper Insurance.

WILLIAM B. HARPER is a former business analyst and petroleum economist on the National Industrial Conference Board; he has been with the Institute since 1950.

W. S. LITTLE, JR., an aeronautical engineering graduate of MIT, has been with Shell Oil for nine years. Prior to joining Shell, he was a Lt., Ordnance, U.S. Army.

number of people with whom he may be able to deal.

"Oxidation inhibitors are required by the military for storage stability, as Mr. Griffin states, and these additives have been thoroughly checked for compatibility. New additives also must meet compatibility and engine performance tests.

"Straight mineral oils also are defined by military specs and approved by engine manufacturers. Additive-type oils represent the individual petroleum supplier's approach to various problems that are encountered, particularly in small engines. It would be extremely difficult if restrictive specifications were issued in this field."

Karl Hess: "*Does anyone know of any specific difficulties raised by the incompatibility of oils?*"

W. S. Little, Jr.: "I don't know of any difficulty, but I do know of cases where the customer was disappointed by what he derived from the use of an additive oil when co-mingled with other oils."

John Griffin: "I don't believe I have ever heard of a case where the operator of airline equipment had this difficulty. Everyone in commercial aviation is thoroughly acquainted with such hazards and they go out of their way to check it ahead of time.

"In a lightplane or a business-plane operation, however, where the aircraft is moved from one airport to another in an irregular manner, the problem could exist."

D. B. Dolan: "We have found in executive aircraft operations that the pilots frequently carry with them their preferred brand of oil for make-up use enroute, rather than take a chance of having to use something that is incompatible."

John Griffin: "Right now we have four or possibly five grades of gasoline, and with the addition of the *Viscounts* to the nation's commercial airports, we have a sixth. The comingling or mixing of these fuels results in a compatibility problem from the standpoint of performance. We all have lived with this compatibility problem which over-shadows anything that might be engendered by additives."

Karl Hess: "*Briefly, what is available today in the way of special additives?*"

W. S. Little, Jr.: "With the exception of TCP, the only other new additive we have had for fuels is that for corrosion inhibition. The need for a corrosion inhibitor exists, and one of these days we will develop one which will not give undue distress in the engine. That again, however, is a function of specific engine-operating conditions and I don't think we can ever get away from it as far as additives are concerned. What one engine will accept, the next one may not. To our way of thinking, the corrosion inhibitor would appear to be a good bet for the next additive to aviation fuels, either a gasoline or a turbine fuel.

"Oil-wise, you are dealing with a question of individual company research and its analysis of the problems that confront the engine operator. Therefore, it is hard to say what is going to come next. Everyone is trying to make better oils, but one approach may be quite different from the next one. The sole goal is to improve aircraft-engine oils for both piston and turbine engines."

D. B. Dolan: "Research has resulted in the development of Gulf Agent 178, a corrosion inhibitor which is ashless and, therefore, depositless, and is effective even in the presence of salt water.

"Gulf Agent 178 is the recently accepted corrosion inhibitor for all military avgas and jet fuel, and supersedes the inhibitor which gives induction system deposits."

Karl Hess: "*I suppose detergent oils would be the most important area of research in lubrication at this point.*"

John Griffin: "I don't know of any product that has had wider research effort applied to it than aviation oil, and I think the industry position at this point is that it is impossible to make oils with detergents for specialized segments of the aviation industry. It is not now possible to make a detergent oil to use freely throughout the aviation industry, at least it hasn't been proved that you can use it that way. Briefly, the situation is that we know many things will not work and a few that will work successfully in limited applications."

D. B. Dolan: "An American aircraft engine manufacturer is currently encountering a deposit control problem in one of his more advanced models when operated on a variety of straight mineral oils. Operation on Gulfpride Aviation Series D has eliminated the problem even though it was started in dirty engines which already had encountered difficulty. Here again is an example of an additive acting as a crutch when the requirements exceeded the capabilities of the oil without additives."

W. S. Little, Jr.: "The other condition we must recognize is the vast spread in operating conditions between the airlines and the private operator. Each operates engines under quite different conditions and their problems are different. I don't know of an airline that is 'Dirtyness Ltd' in its engines, even if we may see engines that are not too clean.

"The airline operator must reduce his oil problem to a question of

(*Continued on page 34*)

CAPITAL AIRLINES *is the first U.S. air carrier to put turboprop transports into scheduled operation. Capital's Viscounts seat 44*

From Pistons to Turboprops

by Capt. Henry S. Weigel

Capital Airlines

The turboprop is a gas turbine much the same as the pure jet. The main difference lies in the fact that where a pure jet develops power by accelerating a mass of air and ejecting it at high velocity, the turboprop converts the high-velocity jet action into shaft horsepower by the use of additional turbines. Horsepower is used to turn propeller, through reduction gears, to propel the aircraft. Let us look at the *Dart* and see how to get this power.

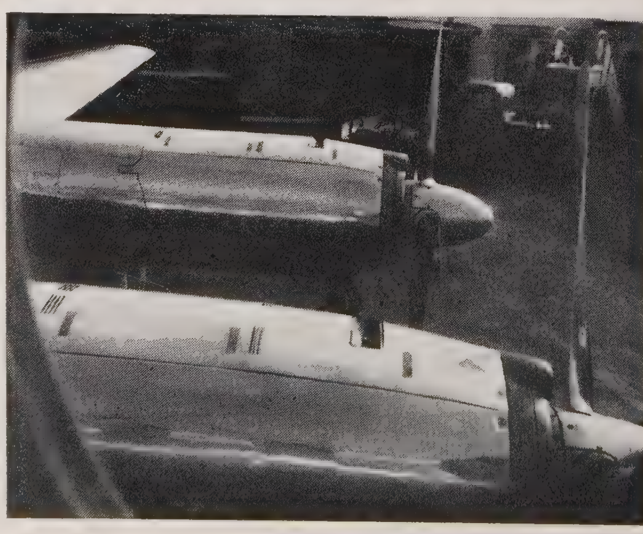
The piston engine operates on the four-stroke cycle principle; intake, compression, power, and exhaust. The gas turbine uses the same principle since both are heat engines relying on expansion of gases for power. However, in the gas turbine the cycle is continuous and occurs in different parts of the engine. Right here are some advantages of the turbine. In a piston the cylinders must be capable of withstanding tremendous pressure on the power stroke and the pressure is continually varying, while in the gas turbine there is nowhere near this peak pressure and pressures remain constant in any given part of the engine. The only motion to produce power is the continuous rotation of one large shaft and a few wheels, and vibration is almost eliminated. In fact, the *Dart* installation in the *Viscount* has no rubber shock mounts between the engine and the airframe. Not only does this mean less fatigue to the pilot and his passengers, but maintenance problems to engine accessories and airframe are reduced.

As air is drawn into the circular air inlet it is directed to the first stage compressor where it is centrifuged to increase the pressure from 15 psi at sea level to 40 psi, accompanied by a rise in temperature of from 15° to 120° C. The air is then directed into the second stage compressor where its pressure and temperature are further raised to 75 psi and 200° C. This is a compression ratio at sea level of approximately 5 to 1.

It might be well to pause here and note the difference between the centrifugal compressor and the axial-flow compressor. The axial flow passes air straight through and much less resistance is encountered by the air because it does not have to change direction. The compression ratio on the axial flow is much higher, somewhere around 9 to 1. This means greater efficiency, less frontal area, and lower fuel consumption per horsepower. The advantages of centrifugal compressors are simplicity and cheaper cost, greater durability and resistance to damage from foreign objects and lower maintenance cost. Where the best pistons have a weight to horsepower ratio of 1:1, the centrifugal flow is about 1:1½ and the axial flow 1:2.

After leaving the compressor, the air is directed into seven combustion chambers where 25 to 30% is mixed with the fuel and burned. The remaining 70 to 75% is used to cool the burning gases down to an acceptable temperature for the turbine. The temperature at the center of the flame, at take-off power, reaches 2,000° C and in a distance of about 20 inches this temperature must be reduced to a maximum of 857° C in order to prevent overheating the turbine components. The air reaches its highest pressure as it leaves the second stage compressor and even loses a slight amount in passing through the combustion chambers. There are numerous carefully located holes in the inner burner can which allow the cooling air to pass through to control the flame and cool the gases. The flame is self-supporting and, once started, needs no other source of ignition.

At their rear end the combustion chambers are attached to a circular nozzle box where the hot gases are evenly distributed and directed to the first stage turbine by fixed nozzle guide vanes. These vanes convert the high-temperature and high-pressure gas to high velocity and direct it at the proper angle to the turbine blades. The gas is then directed through the interstage guide vanes to a second turbine wheel where the same process is repeated at a lower velocity. Most of the energy is converted to rotational speeds to produce shaft horsepower. Remaining energy is expelled out the tail pipe and imparts a small amount of jet thrust to the engine. At sea level the static thrust is 365 pounds at full power. This drops off speed and altitude, the reverse of a jet as far as speed is concerned.



DART *turbines develop 4,550 hp at full power; 3,150 hp is needed to rotate compressor at maximum rpm, 1400 hp goes to propeller*

In the *Dart* the turbines at full power develop 4,550 hp power; 3,150 hp is needed to rotate the compressor at maximum RPM, and the remaining power, 1400 hp, goes to the propeller. Since the propeller is controlled by a constant-speed unit just like the piston, the needs of the compressor are served first, and anything left over goes to the propeller. Propeller reduction gearing is .106 to 1. The higher the forward speed and the greater the ram, the less power is needed by the compressors and the more is available for thrust. This is also true of the pure jet.

The engine is controlled from the cockpit by three controls; power lever, high-pressure fuel cock, and fuel trimmer. The power lever, or throttle, is connected to the fuel-control unit and propeller governor. To operate a turboprop engine, the RPM and fuel flow must be perfectly matched because air flow is controlled by engine RPM and not by a throttle valve as on a piston engine. The air going into the turbine engine is not passed through a carburetor so the fuel can be metered accordingly. The fuel is controlled by the power lever to match the RPM selected. The fuel control unit automatically compensates for pressure altitude and reduces fuel flow as altitude is gained to maintain the proper fuel-air ratio.

The high-pressure fuel cock is full open during engine operation and is closed to cut off all fuel to the engine when desired in stopping the engine or in emergency shut-down.

The fuel trimmer is a form of mixture control operated manually by the pilot to make small adjustments in fuel flow without changing RPM. It is used when operating in temperatures above standard at any altitude. It allows the pilot to make corrections for high OAT, a function which is not handled by the fuel control unit. Automatic fuel trimming is under development which will eliminate this manual control.

Engine starting is quite simple. With booster pumps on, high-pressure cocks open, and throttles closed, the starter selector is set to the engine desired, and the starter button is pushed. This energizes the starter motor and high-energy ignition system. Combustion starts at 1800 RPM, noted by a jet pipe temperature rise, and acceleration continues to 4,000 RPM where the starter button pops out, de-energizing the starter and ignition systems. The next engine is then selected and the procedure repeated. Normal idling is 6,000 RPM. For prolonged idling the fuel trimmers can be set to full decrease and RPM will drop below 5,000 which will result in a fuel consumption of 120 gallons per hour for four engines. When we consider that a DC-3 uses less than 100 gallons per hour at cruise, this idling consumption is quite high.

Engine run-up is unnecessary unless the OAT is above standard. At 12,000 RPM the fuel trimmers are set to obtain the desired JPT on each engine corrected for OAT. On take-off in above-standard temperatures water-methanol is injected automatically in the proper amount to insure full power. This power recovery is obtained up to a maximum OAT of 45° C or 113° F. The system is operated by the power lever when advanced beyond the 14,000 RPM position and is de-activated when reduced below this position or when the water-methanol pumps are switched off.

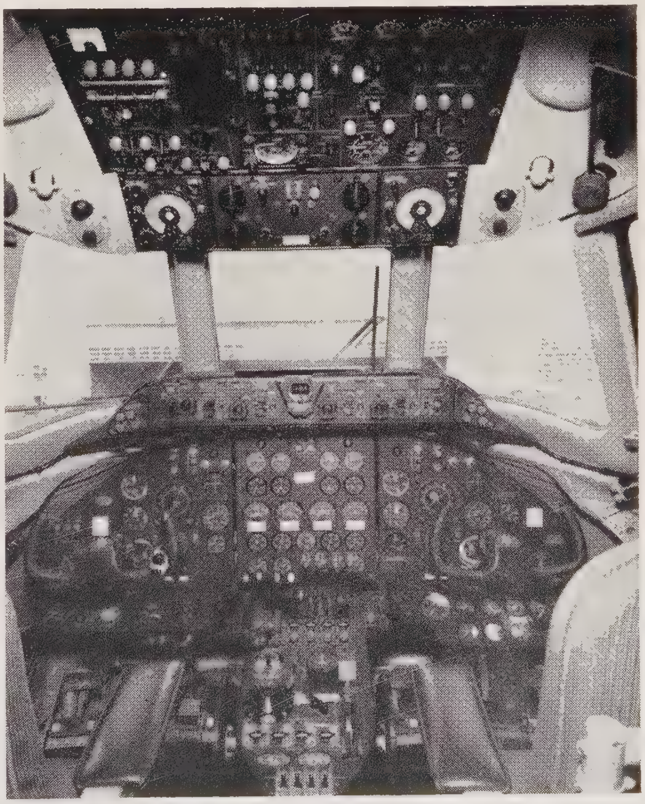
After take-off, RPM is reduced to 13,600. This same power lever setting is maintained throughout the climb and cruise until let-down is started. In warm temperatures the JPT is monitored and trimmed as necessary just as normal monitoring is performed on a piston. Descent is normally made at a very low power setting and a rapid rate of descent.

Fuel consumption on a turbine engine is quite high. Although it is much lower on a turboprop, it is still much more than a piston of comparable power. The best way to obtain the lowest consumption is to fly as high as possible and run the engine at as high an RPM as possible consistent with engine life. The higher a turboprop flies the more miles per gallon is realized, the higher the engine speed the lower the specific fuel consumption. High altitude means more miles per gallon, it does not mean a higher true airspeed as is the case on the piston. On the *Viscount* for instance, on a standard day the highest true airspeed is obtained between 15,000 and 20,000 feet depending on gross weight. On a hot day this best speed range would be between 8,000 and 12,000 feet. Although better fuel economy would be achieved at the highest possible cruise altitude, elapsed enroute time would be greater than the best-speed altitude. Most economical flight, dollar-wise, is usually achieved at the altitude where full cruise RPM can be used with the highest TAS. Wind, stage length, payload, temperature, and weather all have a bearing on the optimum altitude for a given flight.

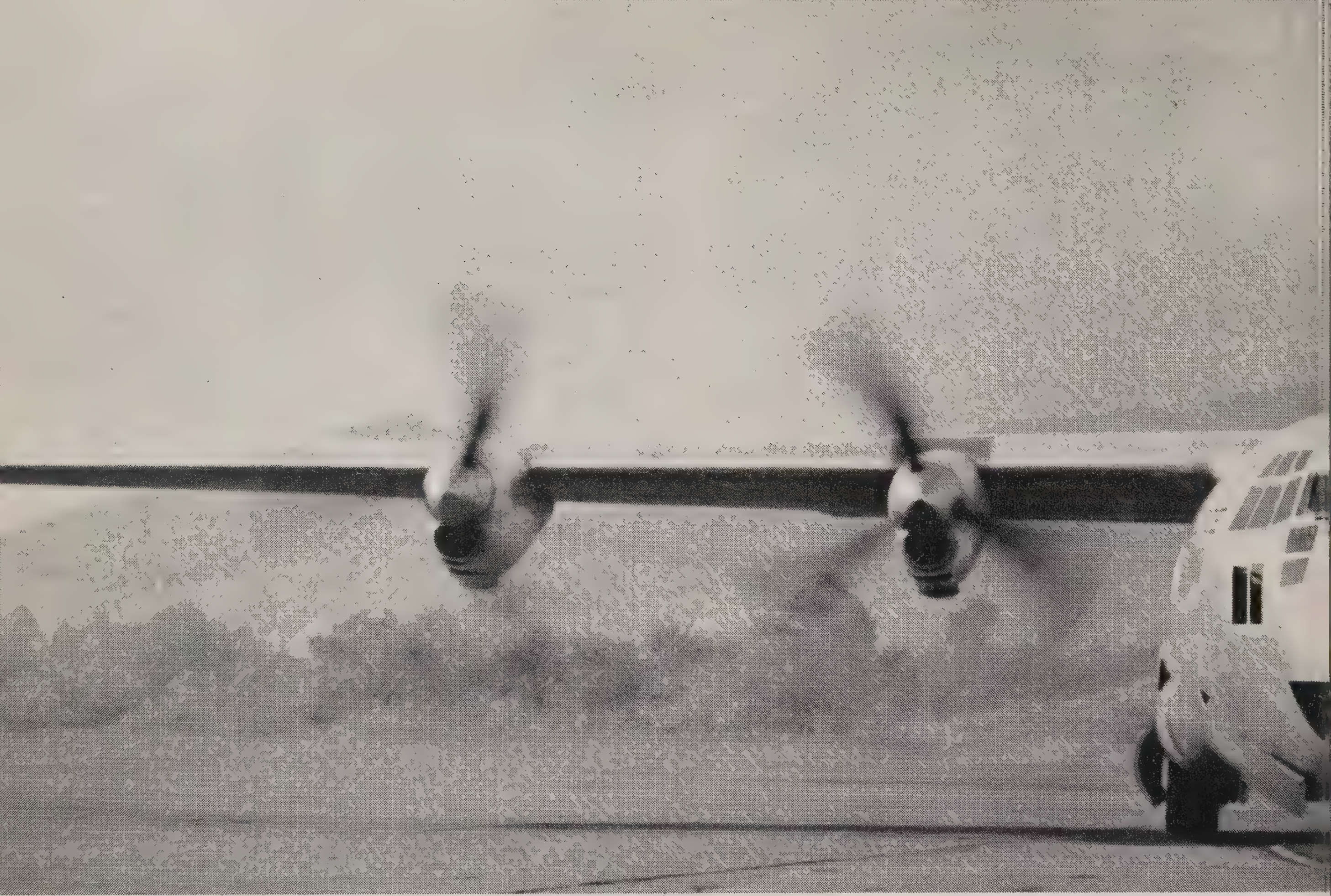
Dart fuel consumption at various altitudes in standard air conditions at cruise RPM of 13,600 are: Sea level—560 GPH; 14,000 feet—430 GPH; 25,000 feet—324 GPH. *Viscount* fuel capacity will be about 2300 gallons.

A piston engine's fuel consumption per hour varies only slightly with altitude, and climb and cruise powers can be maintained at any altitude or temperature. On the turboprop the power drops continually on the climb, and cruise power is dependent on the altitude and temperature. Because most efficient turbine operation is achieved at the highest allowable RPM, the cruise power available at low altitude is so great that *Vno*, or maximum level flight speed, is exceeded. This requires lowering the RPM to stay within the structural limits of the aircraft.

Temperature has a great effect on turbine engines. The higher the OAT the lower the mass air flow at the same RPM and the less fuel can be burned. The less fuel burned the less power is developed. The power loss on the *Dart* is approximately 1% for each degree above standard. If fuel flow is not reduced to (*Continued on page 39*)



VISCOUNT *instrument setup has radio, electrical panels overhead; engine instruments in center, and flight gauges on either side*



MISSION: TACTICAL AIR MOBILITY. Mobility of men and materiel is a vital problem in the new atomic era. So the Air Force needs a high-speed, lo lung combat cargo plane that can use even short, improvised runways. The new C-130 Hercules with turbo-prop power (Allison T-56 engines) will do this. Now production at Lockheed's Georgia Division, Marietta, Ga.

A Pentagon Secret

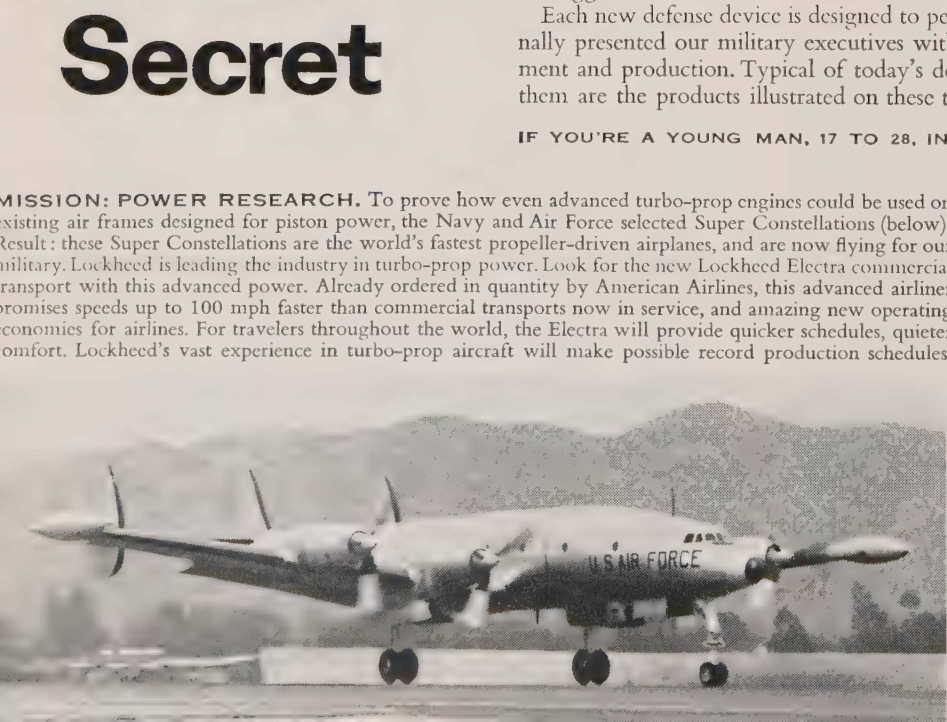
If you were in the vicinity of Alamogordo, Inyokern, Dayton, Muroc Dry Lake or Patux River, you would hear new sounds and see strange shapes in the skies. These and other milit research centers are constantly testing the new flight forms developed jointly by industry and t military—admirals, generals and thousands of officers and enlisted men.

The unique talent of our military executives to mobilize science and industry is the Pentag secret. In this fast-moving age, our defense needs are ever-changing. This requires new weapon new aircraft, and whole new concepts of defense. The job of planning and developing these is no the biggest business in the world.

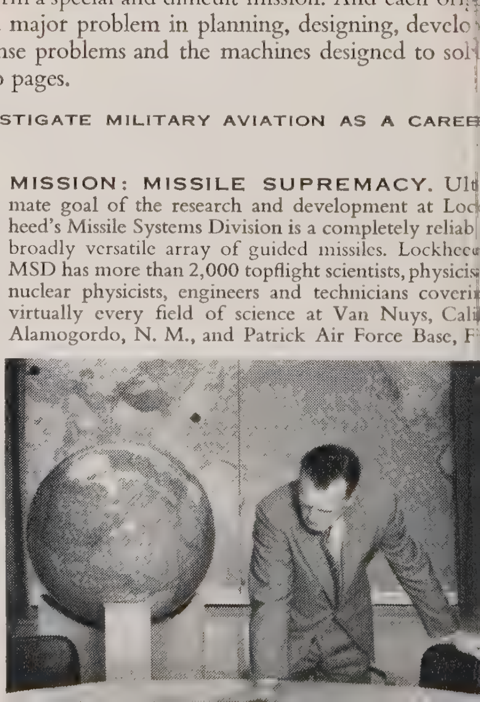
Each new defense device is designed to perform a special and difficult mission. And each ori nally presented our military executives with a major problem in planning, designing, develo ment and production. Typical of today's defense problems and the machines designed to sol them are the products illustrated on these two pages.

IF YOU'RE A YOUNG MAN, 17 TO 28, INVESTIGATE MILITARY AVIATION AS A CAREE

MISSION: POWER RESEARCH. To prove how even advanced turbo-prop engines could be used on existing air frames designed for piston power, the Navy and Air Force selected Super Constellations (below). Result: these Super Constellations are the world's fastest propeller-driven airplanes, and are now flying for our military. Lockheed is leading the industry in turbo-prop power. Look for the new Lockheed Electra commercial transport with this advanced power. Already ordered in quantity by American Airlines, this advanced airliner promises speeds up to 100 mph faster than commercial transports now in service, and amazing new operating economies for airlines. For travelers throughout the world, the Electra will provide quicker schedules, quieter comfort. Lockheed's vast experience in turbo-prop aircraft will make possible record production schedules.



MISSION: MISSILE SUPREMACY. Ult mate goal of the research and development at Loc heed's Missile Systems Division is a completely reliab broadly versatile array of guided missiles. Lockhee MSD has more than 2,000 topflight scientists, physicis nuclear physicists, engineers and technicians coveri virtually every field of science at Van Nuys, Cal Alamogordo, N. M., and Patrick Air Force Base, F



ION: INTERCEPTION. (Right) This
sation trail is a phenomenon caused by great
t high altitude—symbol of the Air Force's new
Fighter, the Lockheed supersonic interceptor too
o photograph.

Lockheed

AIRCRAFT CORPORATION

California Division, Burbank, Calif.
Georgia Division, Marietta, Ga.
Missile Systems Division, Van Nuys, Calif.
Lockheed Air Terminal, Burbank
Lockheed Aircraft Service, Burbank

LOOK TO LOCKHEED FOR LEADERSHIP

SION: JET TRAINING. Aircraft carrier jet
s require highly skilled pilots and, to train them,
S. Navy needed the world's safest jet trainer. The
2V-1, the Navy's first carrier jet trainer (shown
), is a product of close Navy-Lockheed coopera-
Flying about 600 mph, it can land under 100.
visibility and a raised empennage for improved
l are other new features.

MISSION: EARLY ENEMY DETECTION. Like climbing a mountain for a better view, the Navy and Air Force "go upstairs" with radar stations on Super Constellations—long-range planes capable of carrying *tons* of 360° radar. Result: more hours of earlier warning. Below, Navy crews at Pearl Harbor pass inspection near their Early Warning Super Constellations.

MISSION: COASTAL PROTECTION. No other nation has so much coastline to protect from submarine or air attack. The Navy and Lockheed have continuously developed Neptune Patrol Bombers (P2V) for this mission. In addition to high speed and long range, this plane (below) typifies Lockheed's leadership in the application of electronics to aircraft.

SKYWAYS FOR BUSINESS

News Notes for Pilots, Plane Owners Operating Aircraft in the Interest of Business

MOONEY MARK 20 *is new four-placer designed to appeal to businessman-pilot who wants speed, performance and good payload at price under $13,000 (Standard equipment)*

Southwest Airmotive Plans New Business-Aircraft Plant

Dallas, Tex. Plans presently are being drawn for a new Love Field plant and passenger terminal for business aircraft, according to word received from Southwest Airmotive. The new SAC facilities, to be built on the east side of the airport, will include five separate buildings, two to be leased by SAC to other airport users. These buildings will replace the five the firm now occupies on the south side of the field and which must be razed to make way for the City of Dallas' new airline terminal.

The principal SAC service building is to include a smartly appointed and air-conditioned coffee shop, lobby, lounge, flight operations room, aircraft shop, instrument laboratory, radio shop and aircraft storage hangar. In addition three more large hangar areas are to be partitioned off for exclusive use of Dallas business-fleet owners. A number of small shops and locker rooms will be leased to aircraft owners desiring them for use by their crews.

With the completion of the entire SAC layout next year, the company will have two permanent locations on Love Field (the Engine Division plant near the airport's north corner is not affected by the city's new terminal program).

According to SAC vice president Winston Castleberry, "In the past, business-plane owners and crews landing at major airports have had to content themselves largely with inadequate makeshift terminal accommodations tacked onto airplane storage or repair hangars.

"Now," said Mr. Castleberry, "by designing from the ground up, we can offer this type customer a terminal especially designed and built for his use, on a par throughout with his tastes and requirements as a flying business executive."

The entire Southwest Airmotive move is planned to permit continued operations of SAC's highly diversified plant, with no major interruption in customer services. Cost of the new facility is estimated to be in the vicinity of $2,000,000.

AiResearch Aviation Service Sets Up New "Speed-Range" Department

Los Angeles, Calif. An entirely new kind of aircraft service has been set up by AiResearch Aviation Service. Called "Speed-Range" department, it specializes in contouring aircraft wings with a special process so that aircraft will fly faster and farther without increasing horsepower.

The new department is a direct outgrowth of experimentation and experience with boundary layer control by Vance Breese, aeronautical engineer and test pilot, and Ray Parker, research pilot (*See SKYWAYS, June*).

A short while ago the Breese aircraft, a *Bonanza*, had its wings contoured by AiResearch and other modifications made, with the result that the *Bonanza's* range was increased 30%. The CAA has approved the *Bonanza* modifications which included an extension to the cowl flap, special nose cowl ducts to control flow of cooling air through the air intakes, additional plates to fill in nose cowl near the base of the spinner and filling in the gap between the spinner and the blades of the prop.

Following success with this *Bonanza*, the new department was formed; special crews trained to begin wing-contouring and modifications on other aircraft.

AiResearch has reported that it believes this kind of "Speed-Range" treatment will be of even greater value to large aircraft, and plans already have been made to service the "airliner" category.

Mooney Introduces New Mark 20 To Business-Aircraft Market

Kerrville, Tex. One of the newest entries in the four-place field is Mooney Aircraft's *Mark 20*, powered by a 150-hp Lycoming engine, and said to carry a greater payload than any other single-engine four-placer. Features of the *Mark 20* are a laminar-flow wing, a manually retractable tricycle landing gear, steerable nosewheel, engine augmenters, trim and flaps. Fully loaded, it has a cruising range in excess of 950 miles and a maximum cruise (7,000 ft—75% power—2450 RPM at 22.7" Hg) of 170 mph. Its economy cruise (7,000 ft—60% power—2300 RPM at 20.5" Hg) is

PORTABLE *magnetic particle inspection kit enables A&E to check aircraft for surface or sub-surface flaws in few minutes time. With "SempuN" no plane disassembly is needed*

150 mph and stall speed is 50 mph. With standard equipment, the *Mark 20* is priced at $12,500.

Production schedule calls for the completion of 200 aircraft over the next 12 months. Twenty national distributors already have been named by Mooney.

New Portable Magnetic Inspection Kit Now Available in the U.S.

Palo Alto, Calif. A new portable kit for magnetic particle inspection has become available in the U. S. after several years use in England. Called the "SempuN" unit, it is a permanent magnet with unique ball pivots and multi self-adjustable magnetic pins which permit good contact during its use on any size or shape part. Operation requires no electric current.

Inspection with "SempuN" is accomplished by placing it in contact with the part of area being inspected and then spraying the part with iron oxide solution or magnetic powder. The particles of iron oxide or magnetic powder gather on the surface to indicate either surface or subsurface flaws because the lines of magnetic force are broken at that point.

Recently, the Service Engineering Department of a major aircraft manufacturer used the Detector to check a number of planes to determine whether or not a part failure was a chronic problem. The inspection was done in a few minute per aircraft and without aircraft disassembly as compared with needing several hours per airplane to perform the same inspection by disassembly and magnetic particle inspection with other types of equipment.

The Unit is small in size; weighs 11 lbs.

Construction at Allegheny Calls for Pilot Caution

McKees Rocks, Pa. At Allegheny County Airport, business-flying headquarters for the Pittsburgh area, work recently was started on the construction of a concrete taxiway to serve the new E/W runway that was completed last fall. During this construction period, Allegheny's ILS will be moved to the new runway, high-intensity approach lights will be installed, and a new set of centerline approach lights will be located to serve Runway 27.

Over the five or six months period of construction, pilots are asked to exercise added caution because of the necessity for roundabout taxi routes, inability to clear the runway readily, and the presence of heavy equipment. It also will be necessary to keep in mind that the old approach light lanes are *not* lined up with the new runway. The lane serving Runway 27 is 200 feet to the left of the runway centerline, while the lights serving Runway 9 are 50 feet to the *right* of new runway center. Control tower will remind pilots of these conditions.

CAA Announces Straight-In Approaches with DME

Washington, D.C. Very soon pilots using distance measuring equipment will be able to make straight-in approaches at many

(*Continued on page* 40)

. . . . in the business hanger

The United States Steel Corporation has ordered three *Viscounts* for use by its senior executives. Tentative date for delivery is 1956.

Tony Zuma flew Tennessee Gas Transmission Company's DC-3 from Dallas to Houston for 100 hour inspection, both aircraft and engines, relicensing and new interior trim and upholstery by Executive Aircraft Service. Tony is his company's chief pilot and National Business Aircraft Association representative.

The DC-3 belonging to Rockwell Spring & Axle Co., Detroit, has been flown to Northwestern Aeronautical at Holman Field, St. Paul, Minn., for extensive airframe overhaul. Rockwell's chief pilot is Harry Dawson.

Mine Safety, Pittsburgh, has had its DC-3 at Spartan Aviation Service, Tulsa, for an engine change, accessory overhaul, 100 hour inspection and exterior repainting. In addition, an engine analyzer was installed. M. L. Nicholson brought the plane to St. Paul. Mine Safety's Twin Beech also has been in for maintenance.

Henry Byrd, pilot for American Home Realty Company of Dallas, had his company's Aero *Commander* at Southwest Airmotive for 100 hour check.

C. E. "Buck" Newton is due back at Allegheny County Airport after an extensive trip throughout Southern California. Buck was flying one of Pittsburgh Plate Glass Company's DC-3's, and is his company's NBAA representative.

Jim Boyd, pilot for Shamrock Oil and Gas, Amarillo, Texas, brought Shamrock's *Lodestar* to Southwest Airmotive for 100 hour check and general overhaul.

Monsanto Chemical now has its fourth Remmert-Werner executive DC-3. This one is equipped with Collins 17L-51R VHF communications, dual 51R omni with RMI, Collins 51V glide slope, Bendix MN53 marker, Sperry A-12 autopilot and H-5 gyro horizon, ARC F-11 isolation amplifier and dual ARC speakers, and edge-lighted Lucite radio and instrument panels. Ralph Piper is Monsanto's chief pilot and NBAA representative.

The *Twin Bonanza* owned and operated by Whiteman Manufacturing Company of Los Angeles is in the "Speed-Range" department at AiResearch for wing recontouring and other modifications for greater range and speed.

Bob Harlow, former test pilot for Lockheed, brought Transcontinental Gas Pipeline Company's PV-1 to Spartan at Tulsa for 100 hour inspection and installation of Spartan-designed one-piece window fairings. Home base for the PV-1 is Houston, Texas.

Pure Oil Company's Lockheed 12 has been in the hangar at Southwest Airmotive for 100 hour check. Bernie Burnett brought the plane in.

H. H. Glass, chief pilot for Texas-Illinois Natural Gas Pipe Line Co., Chicago, picked up his company's DC-3 at Northwestern Aeronautical, St. Paul, after installation of 200-gallon wing tank and interior reupholstery. Mr. Glass is his company's NBAA representative.

Don Beeler of Murchison Brothers, Dallas, recently bought a Twin Beech D18 from Executive Aircraft Service.

Brown Paper Mill's DC-3 has been in the Southwest Airmotive shop for minor repairs. R. F. Neel flew the ship in from Monroe, La.

J. J. Budro and Charles Hayes brought Champion Paper's PV-1 to Spartan Aviation Service for right engine change, new props, 100 hour inspection and modifications to the PV's bomb bay fuel system. In addition, *Constellation*-type control wheels and engine vent collector tanks were installed. Dick Smith is Champion's NBAA representative.

Odessa Natural Gas Company's *Lodestar* is back in operation after miscellaneous engine repairs at Executive Aircraft Service, Dallas. Pilot Ray Hodge brought the *Lodestar* to Dallas.

John Gildea and Al Wagner brought Heckett Engineering's Super-92 DC-3 to Remmert-Werner for a new exterior paint design and a double engine change. According to the boys' reports, after 900 hours at an average of 650 hp, the powerplants are burning just 50 to 52 gallons per hour per engine, and three quarts of oil.

Morrison-Knudsen Co., of Boise, Idaho, has had a new executive interior installed in one of its DC-3's. Work was done by AiResearch Aviation Service.

Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable business aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National Headquarters are located at 1701 K Street, N. W. Suite 204, Washington 6, D.C. Phone: National 8-0804.

NBAA President Boggess Speaks To ADMA at Minnesota Meeting

NBAA's President, Henry W. Boggess, Director of Aviation for the Sinclair Refinery Co., Tulsa, Oklahoma, recently delivered a thought-provoking speech before the Aviation Distributors and Manufacturer's Association in Brainerd, Minnesota.

Pointing out several of the serious problems facing aviation today, he said, "It is a sad commentary on our industry as well as a serious impediment to progress to find that there are those within the civilian ranks of Aviation whose attitudes and whose actions tend to thwart progress in air traffic control. The recent attempts to scuttle the CAA program of DME is an outstanding example of an action to confound and impede rather than to help solve air traffic control problems.

"Every man, woman and child who uses the airspace, or who has someone near and dear who uses it, owes a debt of gratitude to the Congress of the United States for refusing to kill Distance Measuring Equipment until there is something equally as good (whatever that may be) . . . fully developed and implemented . . . to take its place."

Mr. Boggess also urged uniformity of necessary rules and regulations for all users of the airspace. "Can you imagine what would happen to air safety," he asked, "especially under IFR conditions, if the military were to operate under one set of air traffic rules while civilians operated under a different set of rules? It sounds like a foolish and absurd question, doesn't it? But it isn't. Listen to what the Department of the U. S. Air Force proposed under date of April 25, 1955. Commenting on Senate Bill 1119, 84th Congress, designed to amend the Civil Aeronautics Act of 1938, the Air Force said, and I quote:

'. . . *the terms "air navigation" and "air navigation facilities" should be limited wherever they appear so as to make it clear that the Act does not intend to give a civil agency the statutory authority to interfere in purely Military aviation matters.*'

"Certainly the Air Force does not mean to imply that there is now intended or has ever existed, any statutory provision that gives civilians control over Military air bases. No, they speak of 'air navigation' and 'air navigation facilities,' the facilities on Federal Airways and on civilian airports at your home town and mine. Do they propose to install incompatible, experimental TACAN on our Federal Airways with money from a Military budget despite Congressional designation of VOR/DME for a common system? Do you suppose the next request will be to make Military automobiles immune to civilian street and highway regulations? Either situation would be utterly untenable . . . and wholly unnecessary in time of peace. To grant such a request could be tantamount to grounding 60,000 civilian airplanes."

Commenting on the potentials of aviation, Mr. Boggess concluded, "Actually, there is so much advancement to be made that we can be said to be in the embryonic stages of Aviation's development. The science of aeronautics is young and vigorous and on its way. Powerplants, fuel, electronics, metallurgy, aerodynamics have great potentialities for advancement and it is to be hoped that their forward pace will not be slowed by the limitations of physical man.

"We stand before the dawning of a new day in the Air Age, the day when men everywhere, in freedom and in peace, may use the airspace for the greater development of the human race. The sun will rise over the horizon of this new day no sooner than we squarely face factors of limitations and resolve to do something constructive about them."

CAA Studies VFR Use of Navaids By Aviation's Itinerant Planes

The CAA has a continuing program to develop VFR as well as IFR terminal and enroute air-traffic facts for use in the administration of its airport, airway and safety programs. The program is well along. This report on their program supplies some of the needed air-traffic facts on enroute VFR general aviation itinerant flying on VFR flight plans—a valid indicator of the VFR use of the navaids by general aviation. Now lacking is information on enroute VFR military flying and aircraft operational activity at military bases.

Since the end of World War II, the general aviation VFR use of navaids of the Federal Airways System has increased. The increased availability of reliable airborne navigation equipment and modern aircraft has led general aviation to depend more and more upon radio for point-to-point navigation. However, prior to the CAA study, traffic facts on the VFR use of airways by enroute general-aviation aircraft were not available, nor were other such relevant data as the flow, distance and concentration patterns of general aviation flying.

The CAA study presents certain facts on peak day VFR use of the Federal Airways System by general-aviation itinerant aircraft and patterns of general-aviation flying. The findings and conclusions are based upon the 438 replies received from the 439 CAA communication facilities in response to a request from the CAA Office of Federal Airways. Certain combined station/towers submitted data for their peak day of January, 1955 rather than December, 1954 and, inadvertently, a report was not requested from the one combined tower/center/station at Pittsburgh. The survey instructions to the field stations were as follows:

"A need exists to have origin/destination information on VFR use of the Airways by civil itinerant aircraft. This letter requires only a one-time count of one day's civil itinerant VFR flight plans by each INSACS. It is believed that a one-day sample will suffice; no further counts will be requested unless the one-day sample proves to be inadequate.

"The following procedures should be followed by each INSACS in preparation and submission of the data requested:

"1. Select the peak day for December, 1954, *i.e.*, the day having the largest number of civil itinerant VFR flight plans (Forms ACA-398).

"2. Sort the peak-day civil itinerant VFR flight plans by points of departure. Use name of point of departure rather than location identifier.

"3. Arrange points of departure in alphabetical order.

"4. List each civil itinerant VFR flight showing:

A. Point of departure
B. Destination
C. Distance from (*A*) to (*B*)
D. Type of aircraft
E. Route

"5. We need the opinion of each Facility Chief with reference to the following three questions:

A. Was the peak-day civil itinerant VFR flight plan activity for December, 1954 typical for the peak days of other months in 1954? If not, estimate the number of civil itinerant flight plans handled in a typical peak day.

B. Was the origin/destination pattern for the peak day of December, 1954 typical? If not, please indicate an origin/destination pattern that is considered representative of a typical peak day for the INSACS.

3. It is a fact that not all civil itinerant VFR users of the airways file flight plans.

In your opinion, what percentage of the civil itinerant VFR flights using airways facilities do file VFR flight plans?

Summary of Report

A. *Number of Flight Plans and Aircraft*

1. There were 3,232 VFR general-aviation (itinerant) flight plans filed at the 438 facilities in the six CAA regions on their respective peak days in December, 1954.
2. The 438 CAA facility chiefs estimated that on their respective 1954 typical peak days, there would have been 5,359 VFR general-aviation itinerant flight plans or 65.8% more than the 3,232 for their December, 1954 peak days.
3. The percent of VFR general-aviation users of the Federal Airways who file VFR flight plans varies widely from one section of the country to another, but the variations make geographic sense. Around 25% of the users file flight plans in Regions 1, 2 and 3, as compared with 50% in Region 4, and 80% in Region 5, and 100% in Region 6. These percentages were derived from estimates by facility chiefs (best grass-root source).
4. During their respective peak days of December, 1954, it was estimated that there were 10,000 general-aviation aircraft using the Federal Airways under VFR conditions, and over 16,000 on the peak days of 1954. These estimates are an indication of the magnitude of the VFR general-aviation use of airway facilities rather than an exact count.

B. *Flight Plans by Type of Aircraft*

1. Multi-engine and postwar single-engine four-place aircraft account for only 34.5% of all active aircraft.
2. These active aircraft account for 84% of the VFR general-aviation flight plans. The large number of single-engine two/three-place aircraft had a minimum number of flight plans.

C. *Flight Plans by Type of Hub*

1. The concentrations of active aircraft within the continental United States is related to and largely fixed by the air traffic hub pattern.
2. More than one-half of the VFR flight plans originate in the relatively few air traffic hubs. The distribution of flight plan activity is consistent with the one for active aircraft.

D. *Flight Plans by Distance*

1. Three of every four VFR flights of general-aviation aircraft went less than 300 miles. Data from a prior survey of 80 airports confirm the short-haul character of general-aviation flying.
2. Each type of aircraft has a distinct distance pattern. Multi-engine aircraft have, as expected, a longer haul than small single-engine airplanes. To a lesser degree the length of haul varies by type of air traffic hub, *i.e.*, large hubs have a higher percentage of long flights than non-hubs and vice-versa.

E. *Origin-Destination by Hub*

1. An air traffic hub was either the point of departure and/or destination in 82% of the flight plans handled. Traffic flows between hubs, hubs to non-hubs, but with little traffic going from one non-hub to another. Non-hubs were involved, however, in six of every 10 pairs.
2. While two of every three VFR general-aviation (itinerant) aircraft using navaids report their flights as direct rather than by airway, 83% of the plans were on airways or had routes reasonably parallel to navaids.
3. Three or more VFR general-aviation (itinerant) flight plans during the peak day of December, 1954 constitutes a significant flow of air traffic between dual pairs (count New York-Chicago and Chicago-New York as one) of communities. Three flight plans equal 15 flights due to the seasonal difference and aircraft not filing VFR flight plans; as a rule, one December, 1954 peak day flight plan equals five actual flights during a typical peak day in 1954.
4. Twenty-nine of every 100 general-aviation itinerant flights using airway facilities will occur on dual pair routes; this ratio, however, varies widely by hub types of the pairs of communities. For example, 71 out of every 100 large-hub/large-hub flight plans were in dual pairs as compared with only 16 out of every 100 non-hub/non-hub pair of places.
5. All hub types of dual pairs have average distances of 250 miles or less. Pairs with large or medium hubs have longer distance patterns than pairs involving non-hub locations.
6. Type of aircraft used in dual pairs vary by hub-types of communities in a pair. Multi-engine aircraft dominate only the large-hub/large-hub pairs; small single-engine aircraft had a minor role with maximum penetration in the non-hub/non-hub category.

New NBAA Members

Keokuk Steel Casting Company
Keokuk, Iowa
NBAA Representative: Walter A. Miller, President.
Company Operates: Cessna 310.

Leeward Aeronautical Service
Fort Wayne, Indiana
NBAA Representatives: A. J. Leeward, Pres., Philip G. Mack, Jr., Chief Pilot (Fort Wayne); R. J. Leeward, Carl Moesly, Chief Pilot (Miami, Fla.).
Company Operates: 12 Douglas DC-3; DC-4; Lockheed *Lodestar;* Lockheed PV-1.

W. B. Osborn, Jr.
San Antonio, Texas
NBAA Representative: W. B. Osborn, Jr., Manager; Charles D. Blackwell, Chief Pilot.
Company Operates: Stinson SR-9; Lockheed 18-56; Aero Commander 560.

Potlatch Forests, Inc.
Lewiston, Idaho
NBAA Representative: C. W. Wellman and Clyde F. Martin, Chief Pilot.

L. B. Smith Aircraft Corp.
Miami, Fla.
NBAA Representative: M. A. Madden

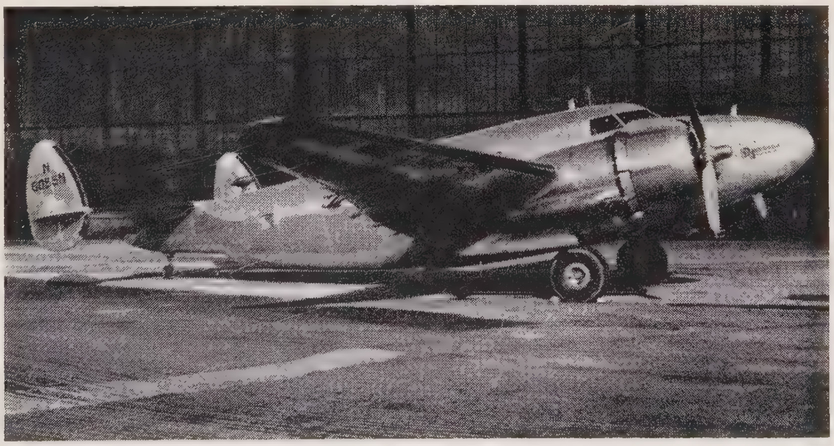
Southern Sash Sales & Supply Co., Inc.
Sheffield, Ala.
NBAA Representative: J. W. Beasley and Charles A. Glock, Chief Pilot.
Company Operates: Beechcraft Model C-50, D-35, C-35; Piper PA-22; Republic *Seabee*

Magnolia Petroleum Company and **Magnolia Pipe Line Co.** (Subsidiary).
Dallas, Texas
NBAA Representative: M. W. Patterson and Sam J. Willis, Chief Pilot.
Company Operates: Douglas DC-3; Aero Commander 520; Cessna 180, 195 and 170; Luscombe; Beech D18S; Bell helicopter 47-G.

Sylvania Electric Products, Inc.
New York, N. Y.
NBAA Representative: R. R. Elliott, Chief Pilot.
Company Operates: DC-3.

Matilda R. Wilson
Detroit, Mich.
NBAA Representative: Carl E. Wickmann, Chief Pilot.
Company Operates: Beech Super E18S.

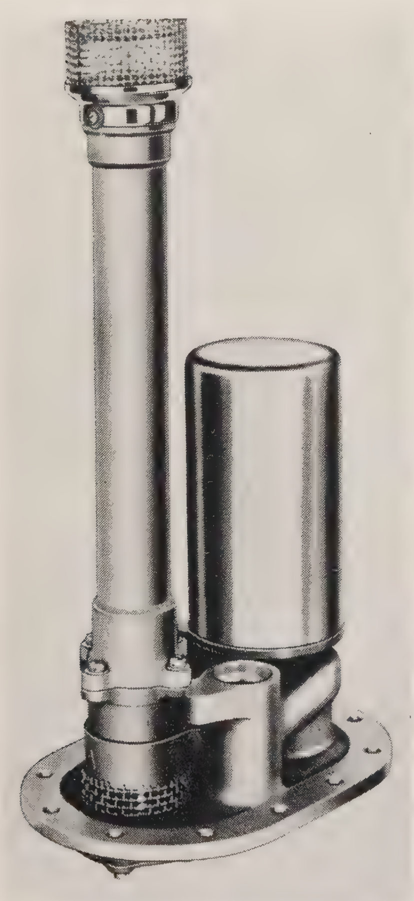
Tidy House Products Company
Shenandoah, Iowa
NBAA Representative: J. C. Rapp, Pres.,
(*Continued on page 37*)



DRESSER INDUSTRIES' PV-1 *was the first military Ventura to be converted for business flying and the only U.S. Navy PV-1 to be so converted; others saw service with the Royal Canadian Navy during World War II. Original conversion was done by Spartan; later re-done by AiResearch. Home base for Dresser's Lockheed is Love Field, Dallas. Chief Pilot and NBAA rep. is L. S. Montigny; copilot is A. E. Hunter*

FUELS-OILS

Features and Facts Pertinent to Successful Flight Operations



FUEL FROM BOTH ENDS—*Using a new valve and long standpipe, this new submerged type fuel booster pump (Lear-Romec) is designed to solve problem of inverted flight*

Lear-Romec Booster Pump For Inverted Jet Flight

Designed to solve the problems of inverted flight in jet trainers, a new submerged fuel booster pump has been announced by the Lear-Romec division of Lear, Inc. It is designated Model RG-11100-2.

Key design parts of the new device are a weighted valve and an especially long standpipe. In normal flight, fuel enters the pump through the bottom of the pipe. In inverted flight, the weighted valve falls and fuel is sucked through the top of the standpipe. Its length of 12½ inches, according to Lear-Romec, means that even in inverted flight it will pump to a very low fuel level.

Inlets of the standpipe are covered with No. 8 wire mesh.

The discharge port fitting is equipped with by-pass valve for internal discharge port. The by-pass valve is designed for minimum pressure drop with the motor off and fuel drawn by auxiliary means. (The discharge port fitting is not shown in the accompanying illustration.)

The discharge fitting's male thread specifications are 1-5/16-12N-3 per AND 10056-16 for 1 inch O.D. Tubing.

Rated capacity of the device is 3,000 pph, with a 16 psi minimum pressure being maintained in either upright or inverted flight.

The pump operates submerged in JP-4 fuel (spec: MIL-F-5624B) and the ambient temperature range is minus 67 degrees to plus 160 degree Fahrenheit to an altitude of 35,000 feet.

Motor for the booster is 0.25 hp at 7200 rpm, 27 volts DC and 15 amperes, continuous duty. The weight is 6.5 pounds.

New Valve Lubricant Claims Wide Use Range

Fuel supply operators have been offered a new multi-purpose valve lubricant by the Rockwell Manufacturing Co. The lubricant, designated Rockwell-Nordstrom No. 555, is said to be unusually resistant to mixtures of hydrocarbons in both acid and alkaline solutions.

Most impressive, however, is the new lubricant's claimed ability to offer good metal-wetting qualities at both sub-zero and highly elevated temperatures.

No. 555, the manufacturer asserts, has an efficient temperature range of 40 degrees below zero to 500 degrees above zero in bulk form and from 20 degrees below to 500 degrees above zero in stick form.

As an indication of the maker's belief in the product's ability and versatility as a plug valve lubricant, Rockwell has announced that No. 555 completely replaces four other lubes in the Rockwell-Nordstrom line. The replaced lubricants are Nos. 542, 546, 548, and 654.

Although the new lube is well-suited for use with crude distillates and even natural gas lines, it is especially recommended also for services involving gasolines, kerosenes, and lubricating oils. It also is useful with glycols, according to the manufacturer. Some of the typical applications of valves in which the lubricant is recommended include agitator draw-offs, loading racks, and transmission lines.

Jet and Rocket Fumes Getting Special Study

Jet and rocket flight has raised some serious questions on the ground as well as high in the air. One of these problems concerns the fumes of jet and rocket fuels and even lubricants. Do they give off poisonous vapors? If so, how poisonous, and what are the antidotes?

On the principle that any possibly poisonous properties of a new material should be discovered first in the laboratory rather than in the hospital or morgue, the Chemical Corps Medical Laboratories at the Army's Maryland Army Chemical Center have set up a special research program to answer the jet and rocket fuel questions.

One of the first reports of the project has just been released by the American Chemical Society through its weekly journal, Chemical and Engineering News. Already, the journal reports, chemists, toxicologists, and pharmacologists at the Chemical Center are making headway toward answers.

In addition to the Army project, the Chemical Society announces, other studies have been assigned to the University of Pittsburgh; the Medical College of Virginia; Hazleton Laboratories in Falls Church, Va., and the Medical College of the State of South Carolina.

Director of the major project at the Chemical Center is Dr. Stephen Krop. According to the Chemical Society report, Dr. Krop lists several score substances—explosives, lubricants, fire extinguishing compounds, hydraulic fluids, rocket propellants, potential jet fuels, solvents, and related chemicals—as subjects of the studies that are now underway.

SOUTHWEST AIRMOTIVE *uses new jet fuel dispenser capable of simultaneously pumping JP-4 into both sides of jet trainer. Southwest Airmotive has government refueling contract*

COMPARISON OF SOME AVERAGE DATA FOR COMMERCIAL AVIATION GASOLINES

Test	Grade 80/87		Grade 91/96		Grade 100/130		Grade 108/135		Grade 115/145	
	1953	1954	1953	1954	1953	1954	1953	1954	1953	1954
Octane number:										
Lean mixture	81.8	81.8	92.5	93.3	Iso+ 0.15	Iso+ 0.19	Iso+ 0.34	Iso+ 0.32	Iso+ 0.59	Iso+ 0.64
Rich mixture	87.7	87.9	98.4	98.6	Iso+ 1.35	Iso+ 1.35	Iso+ 1.76	Iso+ 1.75	Iso+ 2.88	Iso+ 2.92
Tetraethyllead ...... ml./gal.	0.52	0.43	3.96	3.78	4.05	3.81	2.99	3.10	4.56	4.51
Performance number:										
Lean mixture	....	....	....	....	106	107	111	111	118	119
Rich mixture	....	....	....	....	131	131	136	136	146	146
Reid vapor pressure ...... lb.	6.4	6.5	6.6	6.4	6.6	6.6	6.6	6.6	6.5	6.6
D86 dist. temp.:										
10% evap. .... ° F.	148	147	148	147	148	146	148	146	148	147
50% evap.	191	192	192	192	204	204	212	215	212	212
90% evap.	237	234	236	233	246	245	246	251	246	245
Slope at 10 percent evap.	1.6	1.7	1.8	1.7	2.1	2.1	2.4	2.3	2.4	2.5
Visc., kinematic, 70° F. ... cs.	0.609	0.619	0.616	0.608	0.627	0.632	0.643	0.634	0.637	0.633

SUMMARIZED DATA ON AVIATION JET FUELS

Inspection test	Grade JP-3			Referee	Grade JP-4		Referee JP-4		Grade JP-5		
	1953		1954	JP-3 1951	1953	1954	1953	1954	1953	1954	
Number of fuels		2	4	1	28	23	1	1	1		2
Gravity ...... ° A.P.I.	55.6,	50.7	56.5	47.1	51.8	51.5	45.4	48.1	37.3	37.8,	41.0
Distillation temp.:											
10% evap. ..... ° F.	165,	194	160	151	220	216	240	244	397	384,	395
50% evap.	301,	340	265	344	324	319	349	361	432	418,	424
90% evap.	446,	426	421	480	421	425	461	457	491	470,	480
400° F. point percent evap.	—	—	84	—	—	82.5	—	72.0	—	27.5,	16
Reid vapor pressure lb.	5.7,	5.5	5.7	6.9	2.5	2.6	2.2	2.5	0.5	0,	—
Freezing point ... ° F.	<—76,	<—76	<—76	<—76	<—76	<—76	<—76	<—76	—54	<—40,	—59
Viscosity, kinematic, —40° F. ....cs.	—,	3.26	2.15	3.36	3.68	3.26	3.80	3.41	19.4	12.1,	13.36
Water tolerance ... ml.	0.0,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0,	0.0
Aniline point ..... ° F.	132.9,	124	130.5	107	134.8	133.8	106.5	131.4	136	129,	146
Aniline-gravity constant	7,389,	6,287	7,373	5,040	6,983	6,891	4,835	6,320	5,073	4,876,	5,986
Bromine No. gm. Br/100 gm.	1.52,	1.54	1.06	7.3	1.63	1.59	19.6	5.60	4.3	3.7,	0.80
Sulfur											
Total .... wt. percent	0.077,	0.048	0.089	0.35	0.074	0.080	0.265	0.177	0.46	0.33,	0.075
Mercaptan wt. percent	0.003,	0.001	0.001	0.0005	0.0014	0.0016	0.002	0.001	0.003	0.001,	0.001
Aromatic content vol. percent	12.3,	16.0	10.3	25	11.9	11.3	20.3	16.4	8.3	20.3,	15.13
Olefin content	—	—	0.6	—	—	1.3	—	2.3	—	0.9,	0.87
Smoke point	—	—	29.4	—	—	28.7	—	23	—	21,	21
Smoke volatility index	—	—	64.7	—	—	63.4	—	53.2	—	33,	27.7
Gum,											
Existent:											
Air-jet, 400° F. mg./100 ml.	0.7,	0.4	1.6	1.2	1.3	1.3	2.8	1.4	3	2,	—
Steam-jet 450° F. mg./100 ml.	—,	0.4	1.5	1.8	0.7	0.6	—	1.0	2	1,	1.0
Accelerated:											
Air-jet, 400° F. mg./100ml.	1.5,	2.9	1.8	8.4	2.9	—	13.4	14.5	5	2,	—
Steam-jet, 450° F. mg./100ml.	—,	2.4	1.9	11.4	1.7	2.5	—	9.3	4	1,	1.0
Heat of combustion, net B.t.u./lb.	18,716,	18,555	18,715	18,484	18,714	18,678	18,467	18,582	18,474	18,391,	18,569
Hydrogen-carbon ratio	—,	0.1575	0.1680	0.1570	0.1649	0.1635	—	0.162	0.159	0.157,	0.151

The occasional appearance of smoke and fumes in the cabins of developmental jet aircraft is cited as an example of the sort of problem tackled by the Chemical Corps Medical Laboratories.

The smoke and fumes, which appeared to enter the cabin through the pressurizing system, were found to come from the high temperature decomposition of engine lubricating oils.

Although the oils were not toxic, nothing was known about the fumes. At best the fumes were a nuisance. At worst they could cause a critical emergency situation.

Research is now underway to find oils that do not form poisonous substances when they decompose. Another tack, of course, will be to find ways of running the jet engines so that they do not so smokily decompose the lubricating oil.

"The program must answer numerous questions," the Chemical Society report states, "to ensure safety of personnel and of vital equipment which may be jeopardized when personnel are adversely affected:

"How toxic are the chemicals? What can be done to protect military and civilian personnel who make use of them? Can nontoxic substitutes be found? What can be done to treat personnel accidentally exposed?

"The program always comes back to these broad objectives: to guide developmental work where a number of technologically equal candidates are available and to reject the most toxic; to define the magnitude of toxicity of other hazardous military chemicals used throughout the Defense Department for which nontoxic substitutes are not yet in sight.

"It is often the case that only through the investigations of this program can the necessary safety precautions be determined. When a new chemical or family of chemicals is introduced, frequently no toxicity reports have been published. Some of the larger chemical manufacturers now have toxicity studies performed on experimental animals while compounds are still in the developmental stages."

As an illustration of the sort of practical problem being studied in the program, the Chemical Society report points to the removal of aniline, a rocket fuel, when it is splashed on the skin. Although the liquid is potentially quite dangerous to exposed skin it can be combatted quite effectively by prompt washing with dilute acid. But, in everyday practice, this solution itself presented new problems. Getting dilute acids into the supply system extending to field units was one such problem. So, the project was studied further.

Next it was discovered that water alone might serve just as effectively as the dilute acids in decontaminating from splashed aniline. Animal tests proved this—when a fairly large excess of water is used.

Like the aniline problem, many of the fuel toxicity problems are peculiar so-far to the military and the published and industrial experience just doesn't answer all questions. Example is effect of toxic vapors as influenced by altitude extremes of many of today's military flight operations.

Limited water supplies in the field and limited space aboard ships also critically influence the degree of hazard.

Similarly, as the data is developed by the military chemical study, operators facing new fuel fuming problems and questions in commercial fields will be able to form answers based on their own particular problems, limitations, and situations.

As those problems develop, and before they become critical, the Chemical Center project hopes to have all the data for safe, sound answers.

Shell Oil, Slick Airways Sign New Fuel Contract

Covering an estimated nine million dollars of aviation fuel, a new three-year contract has been signed between the certificated air freight carrier, Slick Airways, Inc., and the Shell Oil Co.

The contract calls for the use of Shell aviation fuel through 1959 by Slick's airfreighters on their daily scheduled flights from airports where Shell products are available.

The new contract implements an expansion program now being undertaken by Slick and is an extension of a previous agreement the airfreight company had with Shell.

The present Slick airfreight fleet for which Shell will provide the fuel consists of twenty-two aircraft; two DC-6A's, three DC-4's, and seventeen C-46's.

Survey Shows Little Change in Fuels

From 19 manufacturers of aviation gas and 15 producers of jet fuels, the Bureau of Mines, in cooperation with the American Petroleum Institute, has obtained 131 fuel samples from which to make its annual national survey of av-fuel properties.

Results of the survey are summarized in Charts 1 and 2. To give a basis of comparison as to what each year has brought in the way of fuel changes, survey figures for past years also are included.

The most obvious point about the lists of regular av-gas samples is that, with the exception of tetraethyl lead (TEL) content, the average properties of commercial aviation gasolines from all the major producers involved in these surveys, has changed very little.

Jet fuels, as they grow in use and in specification, show more variables through the years. (In the table for jet fuels, in Grade JP-3 for 1953 and Grade JP-5 for 1954, only two samples are presented and thus the figures are specific and not averages.)

In obtaining the test samples for avgas, a total of 101 fuel lots were used. Among the sample lots, 29 were for commercial use only, 21 were for military use only and 51 were designated for both uses. The averages given in the tables here are for all the samples. (Persons desiring the actual, specific averages of the fuels by use-designation should write directly to the Bureau of Mines, U.S. Department of the Interior, Washington 25, D.C. The report of Investigations in which the data will be found is No. 5132).

Holding Altitudes for LaGuardia to be Revised

A source of irritation to pilots inbound to LaGuardia, and to controllers finally is to be corrected with the revision of the Approach Control holding altitudes to *level* thousand-foot altitudes in lieu of the previous "thousand plus 500" altitudes.

The contemplated change will eliminate the irksome necessity for aircraft to climb and hold "plus 500 feet" when lower altitudes than the one assigned over the area approach gate are not available. Actually, holding at the "plus 500" altitudes posed more of a psychological burden on pilots accustomed to level or even thousands at most other locations. The present or old "hold" is based primarily on taking maximum advantage of terrain clearance minimums which permit the use of 1500 feet and both outer patterns, Flatbush and New Rochelle. The greater burden is placed on the Center controllers who have to apply what amounts to a deviation from their other coincident procedures when routing LGA traffic.

When the change is put into effect, pilots will be cleared to Flatbush and New Rochelle at altitudes of 2,000 feet and up (when an instrument approach is in progress at Westchester Airport, an aircraft may be required to cross Portchester intersection at 3,000 feet, then continue descent to 2,000 feet at New Rochelle!). Clearance to the secondary pattern at Holmes (LGA ILS Middle Marker Comlo) likewise will be at level thousands from 6,000 feet on up. As in the past, these clearances will be issued by the Center when weather conditions at LGA require approaches from one direction only (when pilots on approach from the northeast are unable to proceed south of New Rochelle with 3 miles visibility or better and ground contact can be maintained).

Transistors Modernize Aero Intercom Systems

A transistorized electronic adapter amplifier, small enough to conceal in the hand and built around three tiny transistors, now eliminates the necessity of replacing a plane's complete interphone system in order to utilize modern dynamic microphones and headsets which are becoming increasingly popular today.

RADIO RECEPTOR *Vice Pres. J. J. Clark holds newly developed light aircraft radar beacon in his hand. Unit weighs 10 pounds*

The introduction of aircraft-type dynamic microphones and headsets, ruggidized for airborne applications and offering important advantages over earlier carbon-type equipment, posed imposing conversion problems for operators of aircraft employing the latter type intercom systems. Those operators, especially of the executive class who feel that the advantages of complete intercom and speaker systems outweigh the disadvantages for in-flight use, will welcome the introduction by RCA of this flyweight adapter that measures only 1¼ inches in diameter and 3 inches in length. It weighs only six ounces and requires less current than an ordinary flashlight bulb.

It plugs into the plane's existing interphone system, requires no additional wiring and is powered by the bias voltage of the existing system. Higher quality performance and greater intelligibility of speech communication is the result. The RCA adapter consists of a three-stage amplifier, with three p-n-p junction transistors, which raises the output of the dynamic microphone to a level equal to that of the carbon microphone previously used.

Although designed for airborne use, it also can be utilized for converting mobile radio systems for dynamic microphones and headsets.

EWR-HPN Lo-Altitude Control Eases Air Traffic

One of the disadvantages of business-aircraft operation has been the unhappy fact that most new airways procedures recently have been gaited to the capabilities of pressurized airline aircraft. Both the corporate operators and airline operators of unpressurized equipment have complained of procedures, however justified by ATC convenience, that requires long and expensive climbs, descents and detour routings to travel comparatively short distances.

In the New York area, this has been exemplified by the problem of operating into and out of Newark, Teterboro and Westchester from certain directions. These airports, used most heavily by the business-class aircraft on instrument plan, long have been step-children alongside of LGA, IDL (and also long-range traffic into EWR) in the ATC sense. Executive aircraft southbound into Newark and Teterboro for some time have been assigned high levels over LaGuardia and Idlewild traffic westbound; and executive aircraft desiring routing from Newark to Westchester and vice-versa have had to adjust to flight plan considerations comparable to Washington and Boston routings over the New York area.

With commendable ingenuity, the two ATC staffs most concerned (Newark and Westchester towers) have sought and obtained approval of a lo-altitude routing between their respective stations at 2,000 feet via the 265° radial of the WILTON Omni, SPRING VALLEY intersection direct to the PATERSON radio beacon, direct to the NEWARK Outer Compass Locator, and the reverse routing. Newark Radar controls the portion of the route south of PATERSON to expedite transition to the Newark and Teterboro ILS courses.

The net result is that executive aircraft, many of which base at Westchester but pick up and discharge their passengers at Newark in preference to the other New York airports, now can clear expeditiously back and forth in IFR conditions. Southbound from the north and northeast, they can avoid high altitudes (and icing levels in season) and delay by clearing via Westchester Outer Marker pattern to low altitude, then low-altitude control to Newark or Teterboro.

Light Aircraft Radar Beacons Now Available

In the early days of civilian GCA, it was common practice to refer to this facility as "the poor man's ILS." How misleading this was became evident when more general usage revealed that under conditions of weather when the need was the greatest, light aircraft became virtually invisible on current radar equipment. Even under the best conditions of instrument weather, light aircraft target returns on airport surveillance-type equipment were and still are about 50% reliable.

Despite this, many occasions have been recorded where radar has been the means of averting an accident. On these occasions as well as the many others when radar was incapable of helping, the existence and use of a practical airborne radar beacon or transponder would have resulted in the saving of critical time and lives. The value of such a device is emphasized by the great effort being expended in the development of such a device for the use of larger air-carrier type aircraft. The radar beacon is a *must* for approach control separation identification and for enroute radar control purposes.

For the light business aircraft on IFR plan and any aircraft inevitably exposed to arduous IFR flight conditions, the announcement by Radio Receptor Company of Brooklyn, N.Y., of a new lightweight (less than 10 lbs) miniaturized transponder beacon comes as a welcome boon. The smallest size yet developed (8 inches by 8 inches by 5 inches), the Radio Receptor beacon can be held in a man's hand and is battery powered. Although designed primarily for military rescue and field applications, the midget transponder can be used to reply automatically to any interrogation from ground radar within operating range (VHF line-of-sight).

Another interesting use is for testing radar equipment under conditions in which the use of radar reflectors is impractical or inadequate. Aside from cost considerations, the carrying of one of these beacons during IFR operations could be as pertinent a safety procedure as alternate instrument power sources, radio power and other "in case" gadgetry for light business-type aircraft.

Air-Aids Spotlight

BALTIMORE, Md.—*Straight-in approach on FRIENDSHIP ILS authorized via new HIGHLAND Intersection of ILS course with North course of ANDREWS LFRange. Also back course final approach altitude over ORCHARD BEACH Intersection 1,000 ft msl.*

CHEYENNE, Wyo.—*ILS Glide Path and Middle Marker out until mid-September.*

CHICAGO, Ill. —*Official ceiling reports of 1500 ft or less will be measured by rotating beam ceilometer located at ILS Middle Marker.*

CINCINNATI, O.—*GREATER CINCINNATI (call "Cincinnati Tower" now) Approach Control voice transferred from LFRange to VOR range.*

DETROIT-TOLEDO—*Lo-altitude control between WILLOW RUN Tower and TOLEDO.*

GREENSBORO, N.C.—*Neon approach lights decommissioned.*

MOLINE, Ill.—*LFRange operating as radio beacon.*

MUSKEGON, Mich.—*New VORW located at WHITE CLOUD, 35 mi northwest Muskegon on 114.5 mc, identifying "HIC."*

NEEDLES, Calif.—*LFRange on green 4 changed freq to 269 kc.*

NEWPORT, Vt.—*State-owned MHW radio beacon installed and new airway planned north of BARRE-MONTPELIER in this resort area.*

PENDLETON, Ore. — *Tower now operates 24 hrs daily.*

PITTSBURGH, Pa.—*ILS system shut down at ALLEGHENY COUNTY until mid-October.*

RICHMOND, Va.—*Procedure turn for both ILS and LFRange approach now on WEST side of course because of new TV antenna construction.*

SEATTLE, Wash.—*SEATTLE-TACOMA ILS out until mid-Oct.*

YORKTOWN, Va.—*MHW radio beacon and FM marker commissioned 14 mi north course LANGLEY LFRange, frequency 368 kc, identifies "YKT."*

Washington High-Density Area Rules Announced

As a culmination of a long controversy, the CAA has announced the establishment of an experimental "High-Density Air Traffic Zone" in the Washington, D.C. area, effective August 1 and expiring November 24, 1955. Operations during this period will be observed and evaluated by a special sub-committee of the Air Coordinating Committee, headed by J. N. Rodgers, Chief, Special Operations Branch, CAA Office of Aviation Safety. The CAA Airways Operations Branch will follow the experiment closely because of its responsibility for the air traffic control system.

The measure requires aircraft operating in the zone to be equipped with two-way radio and to establish and maintain communication with the appropriate control tower before entering or operating within the zone. This rule, formerly applied only to IFR operations, now is extended to *all* flights.

Another provision prohibits operations under VFR (which assumes that the pilot can see and be seen by other pilots) unless ground visibility is at least one mile. Previously, VFR rules permitted ground contact flight with virtually no forward visibility, with an ATC or tower clearance. In effect, so-called "controlled VFR" is banned and the requirements of a full IFR operation substituted in visibility less than one mile.

The rules are designed to minimize potential collision hazards and to permit evaluation of the problem of high-density areas, without placing undue restrictions on lightplane operators. To meet the needs of the latter, all airspace *under* 700 feet, south of an East-West line through the Washington LFRange station at Fort Foote, is exempted. An area within a two-mile radius around the Washington-Virginia Airport at Bailey's Crossroads (four miles west of Washington National Airport) also is exempted.

The new rules also limit aircraft speeds within the zone to 180 mph, or to the minimum safe speed in cases where a higher speed is pre-

scribed in specifications for a particular aircraft.

(Editor's Note: The "under 700-foot" part of this "new look" would seem to encourage hedgehopping by an unrestricted class of aircraft. On the pro-side, the aircraft speed limitation seems to be the only substantial contribution toward increased safety in the new rules, already so emasculated by pressure groups that only the comment, "too little and too late" may be a fitting epitaph IF. . . .)

The self-evident fact that placing restrictions *below one-mile visibility only* is no answer (to the established fact that 3 miles visibility is under challenge as inadequate where increasing numbers of uncontrolled aircraft may cross approach and departure paths at random and in all directions) damns this experiment before it begins. And no less ridiculous is the proposition that the high-speed, limited-cockpit-visibility aircraft can still barge around the so-called restricted zone VFR with one-mile visibility. These aircraft should be required to navigate solely within specified approach and departure areas so that all other aircraft can be certain of their routes and avoid them. The problem is not to see how much extra traffic the tower can control between 1 and 0 miles visibility, but it is to find ways of separating the classes of IFR and VFR traffic under conditions where both currently operate intermixed and in potentially dreadful conflict!

Army Contracts with Jep For Supply of Manuals

In a move commensurate with the new look in government policy—to take full advantage of commercial services available in private industry rather than establish parallel government services in competition and with customary inefficiency—the Army has contracted with E. B. Jeppesen Company of Denver, Colorado, to supply all Army Aviators in the Continental United States with the well-known Jeppesen Airway Manual.

Previously, Army Aviation relied on the numerous assortment of government publications covering the subject of cross-country flying, facilities, regulations, etc., with each Aviator necessarily becoming a traveling library. Now, just as the airlines, business pilots and others have found the advantages of "JEP's" well-organized complete service, Army Aviation will employ the constantly revised and up-dated information that has become one of the most important aids to safe flight.

Volume 1 of the Airway Manual, which is comparable to the Flight Radio Guide Manual issued last year as a navigational aid to non-instrument flight, contains complete and excellent navigation charts, planning charts, radio DF facility listings, meteorological data, standard broadcast listings, airport directory section, standard ATC patterns, ATC procedures, CAR's, and special services information such as radar weather vectoring and advisory services. This goes to all Army Aviators regardless of rating. No distinction is made between pilots of fixed-wing and rotary-wing aircraft.

Volumes 2 and 3, complete with the now-familiar area charts, procedure charts and instrument approach and let-down charts (both civil and military), will be distributed to all instrument-rated Army Aviators, including the Army National Guard Aviation sections.

It is worthy of mention that concurrent with the growth of Army Aviation as a separate function of the Army and completely unrelated to the Air Force, the proficiency of Army Aviators has risen to a level that bears no resemblance to the picture once held of a group of VFR-flying, locally operating, somewhat amateur-status pilots in uniform. The demands of the service have so grown that it can only be compared to the growth of business flying, especially in the lighter single and twin class, utilizing the common system of airways and airfield facilities, and demanding the same type of training and proficiency of operation.

The result was almost a foregone conclusion—that Army Aviators would need an efficient and up-to-date flight information service, as supplied commercially only by the E. B. Jeppesen Company. The Army did not make its decision overnight. A number of Airway Manual sets were purchased and placed in use at the Army Aviation School and issued to Field Instrument Examiners and other Army Aviators. Satisfactory and enthusiastic reaction by all resulted in a directive from the Chief Signal Officer which established an operational evaluation by the Aviation and Meteorological Department of the Army Electronic Proving Ground, Fort Huachuca, Arizona. After considerable flying in both actual and simulated IFR, VFR, night and day, by both fixed- and rotary-wing aircraft, the usability, accuracy and simplicity of JEP became evident, and the contract with E. B. Jeppesen Company signed and sealed.

Skyways Round Table

(*Continued from page 19*)

economics: can he pay the sum required for additive oils as against his current cost of operating with straight mineral oils."

John Griffin: "After World War II, the military services made a determined effort to find a way of using detergent oil for military aircraft. The investigation took two years and at the end of that period the conclusion was that it was not successful.

"It isn't that the job hasn't been thoroughly attacked or that the reward for the company that succeeded in doing it would not be large. It's just that it's a difficult job."

Karl Hess: "*What's the main difficulty?*"

John Griffin: "The principal difficulty is that when you put in material effective in certain desirable ways, those materials hurt some part of the engine. Those that do not bother the engine usually aren't effective in the desirable property of detergency-dispersancy."

W. S. Little, Jr.: "It's my feeling that many times the aircraft operator can obtain greater benefits by following proper operating and maintenance procedure that we can build into an oil. In fact, to ask the oil to do the job is putting the cart before the horse. You can clean up an engine and get longer engine life by properly running and maintaining it than you can by investing in the insurance policy of some super-duper oil. The airlines have proved that. There is no airline in the U.S. today that is using an additive oil; they use a straight mineral oil. The military also uses a straight mineral oil."

Karl Hess: "*Would you say, then, that the additive oils are of help for the small operator who doesn't spend a lot of time on maintenance?*"

Frank Klein: "They certainly have helped some of the small-engine builders who didn't feel they could spend money to improve their engines a good many years ago."

Joe Chase: "From the standpoint of maintenance, I suppose the dispersancy level is one of the factors in oil-change time. Is there an indication of how the dispersant is holding up, other than an oil-spot check?"

John Griffin: "There really isn't any effective technique that is available to the individual operator. There are laboratory techniques that will do the job. However, the small-plane operator hasn't the pocketbook to encompass that."

Joe Chase: "We hear a great deal about the oil-spot check; how good dispersancy produces a fuzzy pattern and how, when the dispersancy level is low, the spot is small and sharply defined. Do you consider oil-spot checks inadequate?"

John Griffin: "No, I think they are very good indicators."

W. S. Little, Jr.: "Oil-spot tests are not something you hand out to everyone in an attempt to evaluate every oil in service. It goes beyond that. It goes back to the use of laboratory tests and the fact that the engine manufacturers and the oil companies agree that they would rather rely on lab techniques. The best thing to do is to use

a low oil-change period. Many factors are involved, among them the fact that pilots are pulling these planes out of small fields at high power, and there's always dirt. Therefore, probably the most direct way to attack the problem is to change your engine oil fairly often."

D. B. Dolan: "I certainly agree with Mr. Little. Observation seems to indicate that those operators who change their oil about every 25 hours are the ones who are getting the best over-all results. It is startling to see the difference in engines—one operated by someone who adheres to certain procedures, and another similar engine operated by someone who doesn't show the same care and concern for procedures."

John Griffin: "I'd like to take a look at the future, if I may. In one year or possibly 10 we'll be using turbine-powered aircraft, and those engines will be using oils that are quite different from those we are using today. They will be either petroleum-based and very heavily fortified with additives to improve their performance or they will be made of synthetic materials. Every performance property will have to be boosted to provide an adequate margin of safety in turbine operation. Contrary to popular opinion, the turbine powerplant is not a simple piece of machinery and it does require higher performance in fuel and oil than our present piston powerplants need."

William B. Harper: "You are speaking of higher temperatures involved in the new jet engines?"

John Griffin: "Yes, and that applies to the newer turboprop operations, too. The turboprop engine just doesn't live on straight mineral oil, and there are problems associated with the fact that you are turning over a very heavy piece of machinery to get high speed. The temperatures involved are serious considerations."

W. S. Little, Jr.: "The problem confronting us, regarding these future lubricants is that the low temperature, high temperature and load-carrying requirements are not particularly compatible. Hence, the blending of turbine oils is an acute problem."

John Griffin: "This problem is going to face the whole industry in 1956 when the first American turboprop-powered equipment is put into airline service."

Karl Hess: *"What about the competitive situation when it comes to additives?"*

John Griffin: "I don't visualize too much of a competitive situation in the aircraft fuel problem. The distribution problem involved in supplying a special material to the airlines will be so severe that the airlines will not be able to accept the increased cost it would impose on them. Therefore, the airlines will live with the military-specified fuel supply.

Karl Hess: *"Is there any particular universal demand, performance-wise, that is becoming a problem?"*

W. S. Little, Jr.: "The main thing is to develop fuels and oils that will improve aircraft engine performance.

"Going back to spark plug fouling, TCP represents our approach to that problem.

"We all recognize the demand for higher power and greater efficiency in engines. You will see, therefore, competitive activity through various channels to improve that situation."

Frank Klein: "Speaking of additives in general, no one has mentioned such things as metal deactivators and pour point depressants. I'm certain we all agree that there is a tremendous need for certain additives for fuels and oils, and there will be even greater need in the future. Newly developed additives, better ones to do better things, can come along and help all of us, the suppliers as well as the consumers. For example, every year millions of dollars are lost through rusted steel tanks and pipelines. A suitable rust inhibitor would overcome this.

"Most of the additives we have discussed are those that the consumer benefits from, but there are other reasons for additives, too."

Karl Hess: *"Are there safety factors that are being met in additives?"*

John Griffin: "Definitely, yes. In this compatibility factor that we mentioned earlier, the co-mingling of fuels of different grades, those grades are dyed different colors for identification and to aid in the prevention of this type of mixing.

"The oxidation stability additive prevents the fuel from forming a gum and deteriorating in quality in standing in the tank. Without that additive, deterioration in quality would be serious and it can be harmful to the engine. Therefore, most of the additives that are used are done so for safety reasons."

Karl Hess: *"Gentlemen, SKYWAYS' Ed-*

(Continued on page 38)

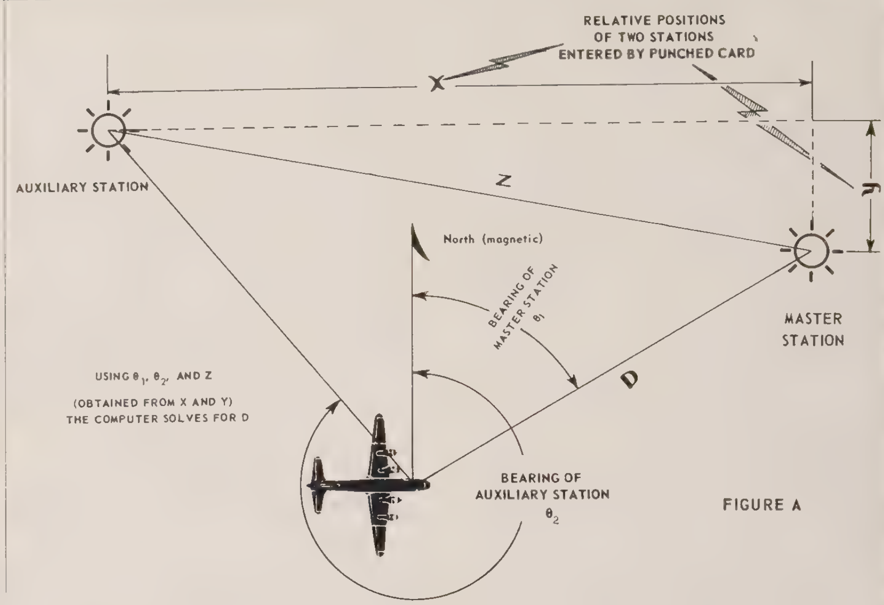


FIGURE A

Lear Autopilot-Navigator

(*Continued from page* 15)

course and, allowing for wind, continually make minute corrections in heading to stay precisely and infallibly on course.

For this robot pilot-navigator to function requires, of course, that the human pilot submit certain basic information. This information is entered via a "card reader," a "waypoint selector," and a "course selector," all parts of the NC-101 systems.

The pilot enters the frequencies and relative positions of two VOR stations into the system by selecting a pre-punched card from a file and inserting the card into the card reader. One of the VOR stations is referred to as the "master station" and the other as the "auxiliary station." In the *Learstar*, the card reader is mounted in a drawer of the buffet just aft of the pilot.

The azimuth and distance from the master station to the arbitrarily selected destination (or waypoint) are entered by turning the knobs on the waypoint selector until the figures appear on the selector's digital indicators. The waypoint selector mounts in a standard 3-inch instrument opening.

The course to the destination is entered by setting the rotatable course bar of the course selector. Setting the heading indicator of the course selector to the same azimuth as the selected course ties in the autopilot for heading information. The course selector, too, fits a 3-inch instrument opening.

From this point on, operation is fully automatic. The card reader accepts from the card the frequencies of the master and auxiliary stations and relays one frequency to each of two VOR receivers. The receivers automatically tune to these frequencies and keep the computor continuously advised of the bearings to the stations. The card reader also accepts from the card the relative positions of the two stations and "remembers" them for the computer.

The waypoint selector acts as "memory" for the computer as regards the azimuth and distance from the master station to the waypoint (or destination).

The course selector keeps the computer continually reminded of the selected course.

Provided with all this information, the computer, utilizing instantaneous and continuous triangulation computations gives to the course selector and to the Lear navigational coupler a running "commentary" on the displacement, if any, of the aircraft from the selected course. This information is displayed visually on the "course indicator" portion of the course selector.

Aided by this information and by a gyro-stabilized magnetic heading provided by the autopilot, the course indicator feeds heading-error information to the navigational coupler which, in turn, keeps the autopilot supplied with a properly corrected heading. In actual operation, with the autopilot engaged, there is rarely any indication of deviation from course, since course displacement is normally detected by the computer and corrected by the autopilot before it becomes great enough to be observed on the indicator.

The computer's diligent triangulation activities produce, in addition to course displacement data, continuous information as to the distance from the aircraft to the destination (or waypoint). This information is fed to the "distance indicator," where it is displayed visually, in miles or knots. The distance indicator is a standard, needle-type, three-inch aircraft instrument. When the distance indicator reads "0", the aircraft has arrived over the destination (or waypoint). An additional indication of arrival is the reversal of the *To-From* flag on the course indicator.

Since the aircraft as well as the waypoint must always be within the service range of both the master and auxiliary omni stations, a series of waypoints is required for flights to destinations more than about 200 miles distant. These waypoints can, of course, be selected and all necessary data prepared in advance. Then upon crossing each waypoint, the pilot need only insert a new card and reset the waypoint selector and course selector for automatic flight to the next waypoint, or to the final

destination, as the case may be.

The Lear L-5 autopilot system is the commercial version of the famed F-5 system which in 1950 won the Collier Trophy, aviation's highest award, for making possible all-weather operation of jet fighters. It includes a navigational and approach coupler, a completely built-in gyrosyn compass, an automatic altitude controller and a side-slip detector. The system features modular construction of all primary units, for lower system weight and minimal maintenance. Installed weight of the combined units, the L-5 and the Collins NC-101 system, is 173 pounds.

The Lear Aircraft Engineering Division's unique achievement of automatic utilization of the navigational data furnished by the computer system offers aircraft operators manifold benefits. A pilot can confidently turn over to his airplane the entire problem of navigating and flying with beam-riding certainty to any of numberless destinations not blessed with beams. Furthermore, speed is increased through the elimination of navigational errors and by virtue of smoother flight under continuous autopilot control. Economy of operation is improved by the same factors. Most important, safety is greatly increased by virtue of the facts that arrival at destination is automatic, pilot fatigue is reduced to a minimum, and pilots are free to devote most of their attention to weather, engines, terrain, and other aircraft.

NBAA

(Continued from page 27)

and Kenneth Moles, Chief Pilot.
Company Operates: Aero Commander 560; Cessna 195.

Gibbs Corporation
Jacksonville, Fla.
NBAA Representative: G. Lester Stanley, Chief Pilot.
Company Operates: DC-3.

Forest Oil Corporation
Denver, Colorado
NBAA Representative: R. M. Agee and Raymond V. Johnson, Pilot (Bradford, Pa.); Marlin H. Fischer, Pilot (San Antonio, Texas).
Company Operates: DC-3; Beech D18S.

Southern California Aircraft Corp.
Ontario, Calif.
NBAA Representative: A. W. Bayer and A. O. Misener, Chief Pilot.

Morane-Saulnier Jet Shown to Executives and Pilots

Several Sinclair Refining Company executives and pilots recently took a long look at the MS 760 when Beech Aircraft brought the business-jet to Westchester Airport, White Plains, N. Y. A. S. Bandak and Joe Lacey flew in the four-placer and reported it a great thrill. Beech Aircraft is sponsoring the French plane in the U. S. and holds option for local manufacture.

Canadian Pilot Group Reminds Air Travelers of Canadian Regs

Many an American businessman flies into Canada in anticipation of good fishing or hunting throughout a vacation period. Recent word, however, from Canada, reports that in some cases these air traveling, vacationing businessmen have lost out on their planned junkets because they failed to comply with the regulations established by the provinces visited. R. I. Thomas, Manager of Canadian Owners and Pilots Association, writes a word of caution:

"Since our Canadian Travel Bureau does not include specific instruction on the need to meet Provincial regulations, we thought you might be interested in cautioning the visiting air travelers regarding the need to check with the Provincial authorities as well as the Dominion authorities regarding the regulations they must comply with.

"Briefly, in addition to the normal Customs and Immigration permits, each province requires that tourists purchase fishing and/or hunting licenses, whichever is appropriate to the season. In some areas a travel permit also must be obtained. If the visitor wishes to take a rifle into the bush country with him during fishing trips, he is advised to check with the Game Warden of the specific area for detailed information as to permits required. Additionally, New Brunswick's Forest Fire Law prohibits non-residents from entering forest areas without a licensed guide, and the Fisheries Law prohibits angling from a canoe or in forest areas without a licensed guide.

Skyways Round Table

(*Continued from page 35*)

itor, D. N. Ahnstrom, has tossed a query on the table and I'll pass it along to you: What recommendations regarding the use of fuel and oil would you men pass on to the operators of the thousands of business planes? Mention has been made of airline operations, but what about the executive aircraft?

D. B. Dolan: "We recommend frequent oil changes for business-plane operations. Experience has indicated that frequent oil changes are desirable as it allows the removal of fuel soot, oxidation products and dirt, and thereby will produce the best end result in engine condition and engine life. That 25- to 50-hour period we mentioned holds good when coupled with moderate engine-operation procedures.

"I'd like to further point out that we are not recommending the use of detergents in radial engines at this time. The auto industry's early experience with detergents showed that they released old deposits which may have been lying there in the engine and doing no particular harm. Later developed detergents, however, do not release the old deposits but do prevent the formation of new ones."

Karl Hess: *"What about the magnetic deposits on spark plugs as a result of the use of tetraethyl lead and detergent oils?"*

John Griffin: "The answer to that lies in my earlier statement that efforts to use detergent oils for high horsepower rated engines cannot be universally successful. Materials put in the oil that are effective in keeping the engine clean do produce such effects as you mentioned and, therefore, cannot be used.

"The higher the horsepower output of the engine the more severe the operating temperature and the greater the heat release in the combustion chamber. That is one of the reasons large piston engines are very sensitive to small differences in fuel and oil composition. If material is introduced which increases the amount of deposits under some operating conditions, it can be catastrophic to the aircraft engine. That's the main reason why detergent aircraft oils for high-output radial engines are not widely used."

W. S. Little, Jr., "No one wants to give people the idea that additives are bad. They are not. However, under some conditions those additives might not be as good as some think they are."

D. B. Dolan: "Gulf takes exception to Mr. Griffin's statement that materials put in oils to keep engines clean produce bad effects on spark plugs. Newer detergents are available and have been used that do not effect spark plugs. United Air Lines and the USAF have tested detergents which were perfectly acceptable, but were not sufficiently effective *only* because UAL and the Air Force did not wish to change the oil often enough to be completely effective."

W. S. Little, Jr.: "The operators of executive aircraft would be wise to use the services available to them through the engine manufacturers and through the petroleum suppliers, as to how their aircraft can be utilized to the highest level. Those services exist and it's just a question of getting together and talking over the problems."

Karl Hess: *"Mr. Griffin, would you summarize the additive situation for us?"*

John Griffin: "Additives for aviation fuels and oils have been widely and successfully used almost from the beginning of commercial aviation. However, there are certain limits on the use of additives that are imposed by performance. The gains to the company that surmounts these barriers will be considerable. As a result, a lot of research is being done to find ways around the barriers and to further improve fuels and oils which already are highly successful."

W. S. Little, Jr.: "The progress we already have seen in the use of additives will continue in piston engines and in turbines. As we look ahead, it appears there will be more additives used and that we all have one goal—to improve the performance of aircraft engines and to increase the level of safety in aircraft operations."

Karl Hess: *"Summarizing the entire discussion, point by point, these facts seem to have been established:*

"1. It is the additive, TEL, upon which the supply of avgas actually depends today. Yet that additive has brought us the problem of spark plug fouling because of lead deposit, and has meant the introduction of another additive to eliminate or clear up the deposition of lead. Thus, it is necessary and is a fact that care is exercised to make certain that each new additive engenders as few new problems as possible.

"2. We have established that selective and not random use of additives is the wise course to follow. Particular engines and particular operating conditions demand particular additives. But when all these conditions are brought into line, the additives can do an unparalleled job for the aircraft operator.

"3. The makers of additive lubricating oils discourage the assumption that mixing different such oils is sound practice. At best, it means that any oil failure could not be traced to a single product, and, at worst, it could mean actual flight trouble.

"This mixing of oils is a particular problem for those plane owners who may be serviced at smaller fields where regularly used products are not available.

"4. Basically, the two major new, fields of additive availability today are TCP, to reduce spark plug fouling, and corrosion inhibitors. In lubricating oils, the use of detergents is opening vast new fields.

"5. The discussion has clearly pointed out, however, that proper engine maintenance, good oil-change schedules, etc., will benefit aircraft operators as much as any special beefing up of the oil itself. Perhaps only for lightplane operators do additive oils offer effective backstopping to maintenance problems.

"Gentlemen, SKYWAYS thanks you for participating in this discussion, and we hope that these Round Tables, which serve as bounceboards of opinions concerning all phases of flight operations, will serve the petroleum industry as well."

Pistons to Turboprops

(*Continued from page* 21)

match the reduced mass air flow, excessive JPT results and the turbine components are damaged or their life shortened. About the only way a pilot can damage the engine is to exceed these allowable JPT's.

It is quite evident then that high temperatures reduce operating ceilings, rates of climb, and increase over-all fuel consumption. On take-off, however, water-methanol is injected into the first stage compressor to increase the mass air flow and regain the fuel which would be trimmed off. This regains full power, except for field elevation, until RPM is reduced below 14,000. On a piston engine, under high temperature and humidity conditions, approximately 10½% to 11% of the power is lost. Piston engines generally have an excess of throttle at sea level and can maintain powers to their critical altitudes for various settings. The critical altitude on a turboprop is sea level. Some de-rated turboprops are being developed which retain full power to altitude. In fact, the *Dart* 506 we will be using is de-rated by a small amount.

Propellers on turboprops are different in that they must have a lower minimum blade angle for engine starting and idling. This is necessary to reduce starter loads so that allowable JPT's will not be exceeded. On the *Dart* this low pitch or ground fine pitch stop is set at 8°. If an engine were to fail on take-off or in flight this 8° blade angle would cause excessive drag. To eliminate this, another stop is built into the propeller at 21° and is called the flight fine pitch stop. Its purpose is to allow a minimum of 21° if an engine failure occurs on take-off or in flight. This stop is so arranged that it moves into place on take-off when RPM is advanced above 14,000. This is indicated by a warning light going out. At touchdown on landing, these flight fine pitch stops are withdrawn to unload the engines for idling and in doing so provides a certain degree of propeller braking for shorter landing runs.

In the event of propeller-governor failure, an overspeed governor on the fuel pump reduces fuel flow to control engine RPM at the overspeed setting of 15,500. Auto-propeller synchronization is also provided. Auto feathering is always armed at take-off power. If the torque pressure drops below 50 pounds, the circuit is completed to energize the feathering motor and raise the pilot valve in the governor to direct the feathering oil pressure to the course pitch side of the prop-control piston. The feathering button is pulled in automatically and a red light in the button indicates that auto feathering is occurring. Even though the feathering motor failed to operate, the propeller would go to within a few degrees of full feather or engine-oil pressure alone. This is also true for manual feathering. To manually feather, the high-pressure cock is closed and pulled through a detent to the feather position. This action mechanically raises the governor control valve and engine oil is directed to feather the blades. The button is pushed in, but pops out immediately. No feathering will result below 14,000 RPM, even if the feathering button is pushed in, unless the high-pressure cock has been pulled off and back to the feather position. This feathering feature is quite unique as compared to piston-engine systems. Although ALPA policy on piston engines favors auto-indication rather than auto feathering I would not, at this point, favor the same policy on turboprops. This is based on *Dart* operators' experience; there being no case, to my knowledge, of inadvertent feathering on take-off, or in fact, any auto-feathering at all to date.

Since a smooth unobstructed air flow is required through the engine air inlet, the propeller, spinner, and leading edge of the cowling are de-iced electrically, power being supplied by an engine-driven alternator. De-icing is so arranged that the ice is broken off in relatively small pieces. The front part of the compressor vanes is made of steel and chews up the ice so that it is no more than water vapor when entering the combustion chambers. Buckets of ice cubes have been put into the engine to simulate severe icing or hail. Even if a large chunk of ice were to get to the combustion chambers and extinguish one or two of them, a quick jog of the throttle would relight them.

The oil system is an integral part of the air inlet casing and external oil lines are at a minimum. Synthetic oil is used to lubricate bearings and reduction gears, and furnish oil for prop governor, torquemeter, and water-methanol control. Oil capacity is 4 gallons and consumption is negligible. Synthetic oil is used because of its greater lubrication qualities and constant viscosity over a wide range of temperatures.

Capital will use kerosene for fuel. JP-4 can also be used if the fuel control unit settings are adjusted for its use. The use of kerosene should increase our safety margins in the event of fire regardless of its origin. Its low volatility will allow much more time for passenger evacuation in the event of a crash fire.

As far as operations are concerned, we expect fuel consumption to be our greatest problem. Idling fuel consumption on a piston is far lower than a turboprop. For this reason a long ATC delay might necessitate

waiting at the gate until such time as clearance is imminent or is received. This is common practice in Europe. Because of our more highly congested airports, this will require a far more difficult solution. It might be hard to convince our fellow pilots who have been waiting for take-off on the taxi strip that we have been delaying our start in order to conserve fuel and actually had called for a clearance before they had taxied out. If prolonged holding for landing clearance is necessary, we naturally will want to hold at the highest possible altitude where consumption is lower. This is going to be quite a trick at some of our high-density airports and still maintain our landing sequence. CAA traffic control people have done considerable research on this problem.

Passage through active frontal thunderstorm activity usually means an altitude much lower than the optimum for low fuel consumption. For this reason alone, airborne radar is more necessary on a turboprop than a piston-engine airplane. Although provision is being made for the eventual installation, we have no idea when radar can be expected.

In listing the advantages and disadvantages of the turboprop, I consider the following to be safety gains:

1) Simplicity of operation, especially when automatic fuel trimming comes into use.
2) Full take-off power available, except for field elevation, regardless of temperature or humidity.
3) A 100% temperature accountability past all obstructions on take-off.
4) The reduced fire hazard due to the use of kerosene.
5) Propeller feathering features.
6) Reduced pilot fatigue due to less vibration.

The only disadvantage apparent at this time is the rate of fuel consumption and all the problems connected with that. My main reason for listing this is because our pilot group has been faced with a minimum of fuel problems on our DC-4 and *Constellation* equipment, and the problem will be much more acute on the *Viscount*.

I hope this has given you some idea of what the turboprop is and how it works. The airplane is essentially no different from any other, but I am convinced that the engine will, after a period of complete familiarization, give us more trouble-free service than our piston engines.

Skyways for Business

(*Continued from page* 25)

airports instead of having to go through time-consuming maneuvers. Present CAA regulations require a pilot to make certain turns and maneuvers to ascertain his position with certainty before descending at most airports. After criteria has been established and procedures published (by mid-August), pilots using DME will be permitted to proceed straight-in to the airport as long as it does not interfere with other traffic.

The time saved by a straight-in approach ordinarily runs between eight and 10 minutes, and with the direct operating cost of large business and airline transports running as high as $8 or $10 a minute, the saving in aircraft operating cost is substantial.

The decision on the part of the CAA's Office of Aviation Safety is a result of the high degree of accuracy demonstrated by DME. The ruling applies to private aircraft as well as business and airline transports.

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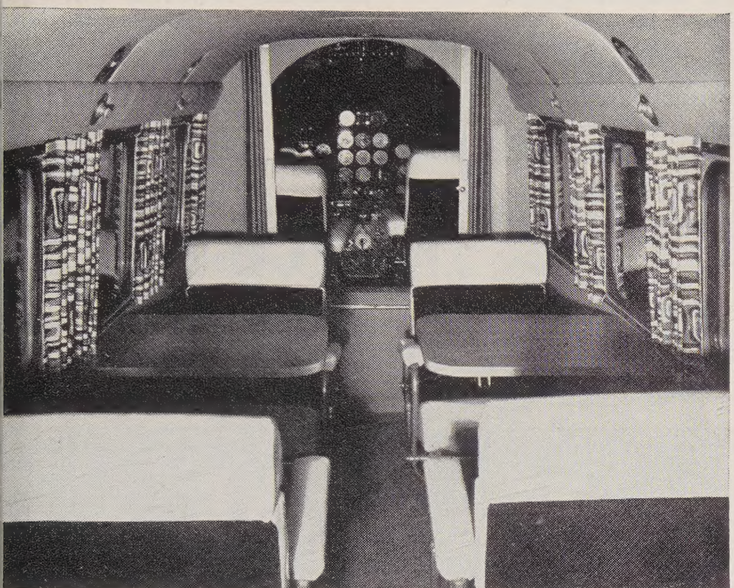

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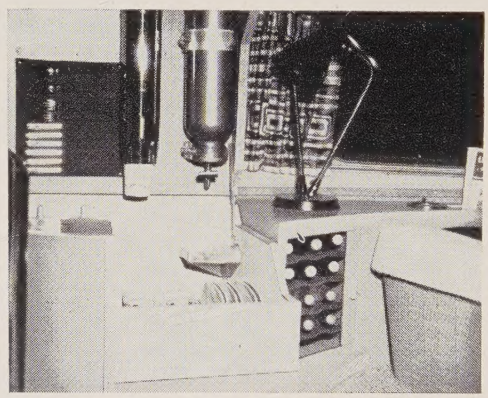

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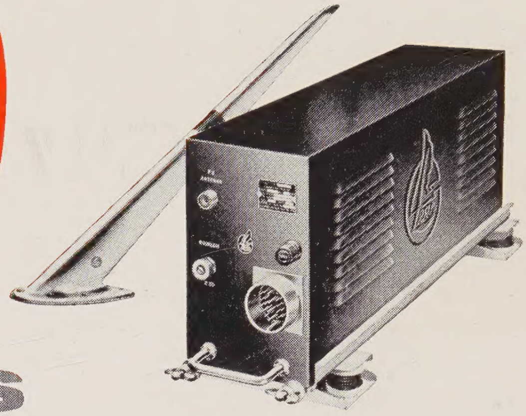

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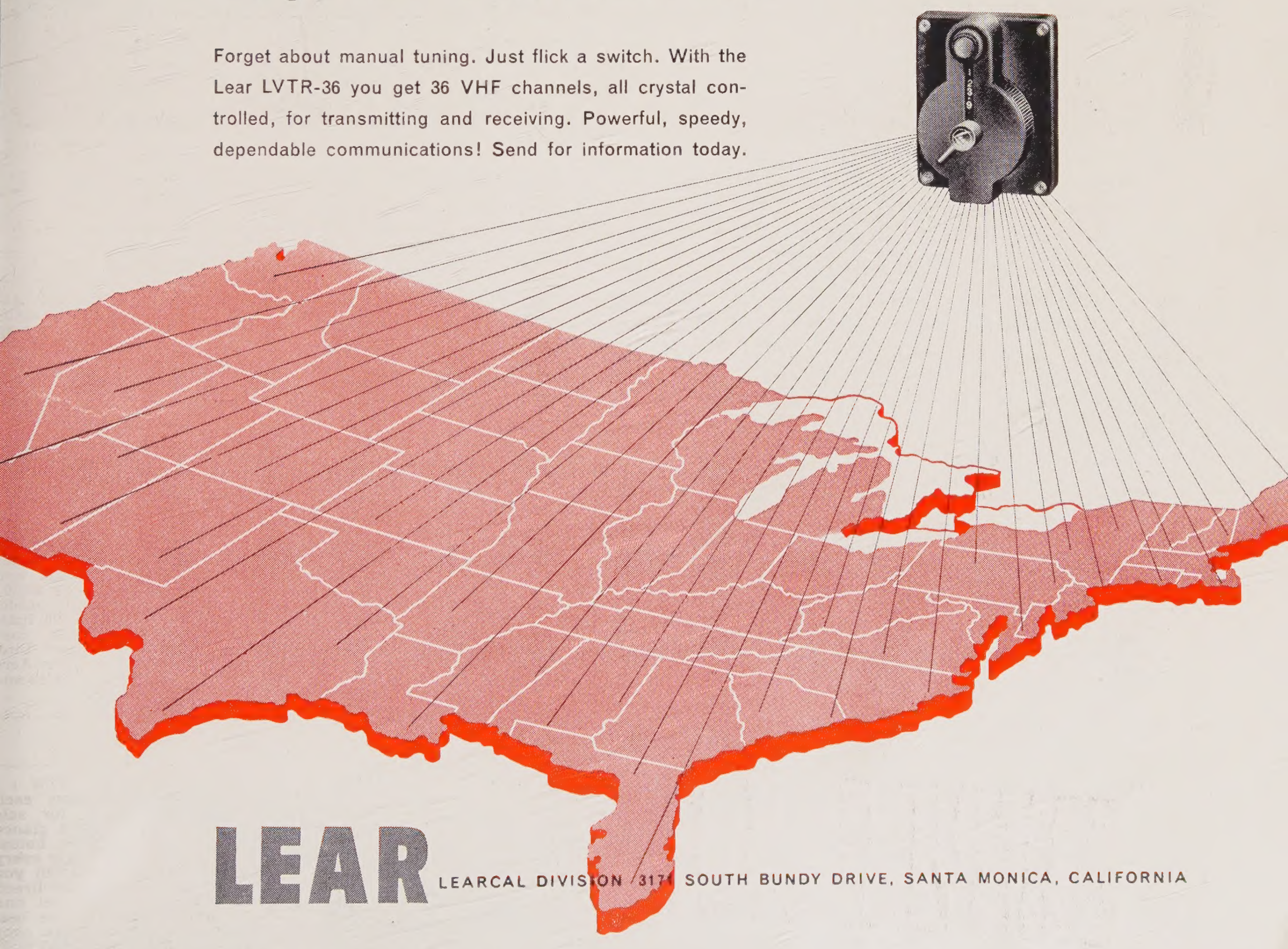

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